ANALYSES
OF
BRITISH
COALS AND COKE.

A GUIDE
TO THE
PURCHASE OF COAL.

HIRSTRIGG reg. **Anthracite Fuels for Gas Producers, &c.**

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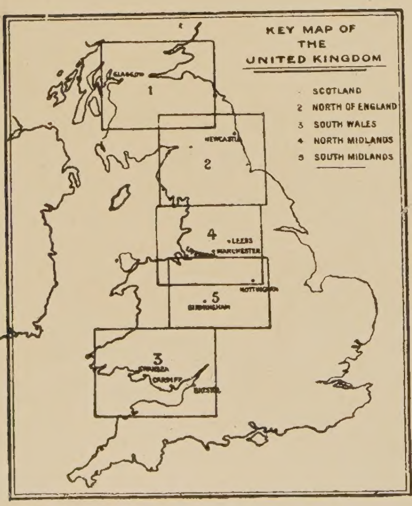

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BRITISH COALS & COKE

A GUIDE TO THE PURCHASER OF COAL.

Compiled by ALLAN GREENWELL, F.G.S., Assoc.M.Inst.C.E., M.Inst.M.E.

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And J. V. ELSDEN, F.G.S., B.Sc.(Lond.).

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INTRODUCTION.

IN the following pages an attempt is made to explain the meaning and use of chemical analysis in determining the value of a fuel. In this country it would seem that the worth of coal analyses is not yet fully realised, and too seldom is practical use made of them. It is hoped that special attention will be given to the section on the purchase of fuel, and that the methods there described may gradually come to be more used in this country.

It will be noticed that nothing has been said upon the classification of coals. This important subject has been dealt with by Mr. C. A. Seyler in the introduction to the first edition of this book; this is reprinted as an appendix, to which the reader should refer. At the present time, Mr. Seyler's classification is not only the most complete, but it is the one based on the most scientific foundation, and deserves careful study by all those who are interested in this important subject.

The subject will be discussed under the following heads:—

1. Some Applications of Coal and Coke.
2. The Purchase of Coal.
3. The Meaning and Interpretation of Coal Analyses.
4. The Calorific Value of Coal.
5. The Storage of Coal.

SOME APPLICATIONS OF COAL AND COKE.

The following remarks upon some of the applications of fuel are not intended to do more than suggest some of the characteristics which render certain classes of fuel suitable for special purposes. It must be remembered that in practice it is not always economically possible to use the fuel most suitable for a specific purpose. Thus considerations of heating efficiency may demand the use of a fuel which cannot be obtained cheaply, and it may then be more economical to use a less efficient fuel at a lower price. Whether this is the case will depend upon the circumstances, and it must not be overlooked that it is always possible that the cheaper fuel may, in the long run, prove to be the dearer.

STEAM COAL.

The value of coal for steam raising purposes does not depend only on its calorific value, though this is undoubtedly a most important factor. Of the total heat evolved, probably on an average not more than about 65 per cent. is transferred

to the boiler, though tests have been recorded in which 85 per cent. of the heat was utilised. A great deal will depend upon using that coal which is most suitable to the style of boiler, system of firing, and design of furnace. A large combustion per square foot is necessary if the draught is poor or the grate small, and this necessitates a fuel which will allow plenty of air to pass through it. If a highly bituminous coal is burned in a furnace designed for coal containing only a small percentage of volatile matter, there will probably be a great loss of heat due to volatilisation without combustion of a large proportion of the volatile constituents, while the same coal might give satisfactory results in a properly designed furnace, and with a special system of firing. The nature of the ash must be considered, since a coal otherwise suitable may give an obstinate clinker. The amount of ash is also of importance, in relation to the decrease in thermal value, its action in clogging the air spaces and diminishing the draught, the amount of unburned fuel carried away with it, and the cost of handling, labour of firing, and removal of the ashes. It is stated that when the amount of ash approaches 40 per cent., the value of fuel is practically *nil*, since although combustion may take place the temperature remains so low that steam cannot be raised.

Dust is also objectionable, as it stops the air spaces and impedes the draught, and it has been suggested that so much improvement might result from ridding coal from dust, that the small loss in combustible matter would be unimportant in comparison. While dust when mixed with coal is undesirable, systems of firing with coaldust alone have been devised with more or less success.

Much sulphur is objectionable on account of the acid, and therefore corrosive, nature of the products of combustion. Moisture means loss of heat, and in examining an analysis it is well to note if it has been performed on the dry sample; if so, the moisture contents should be considered, since, however good the coal may appear from the analysis on the dry sample, a high moisture figure may decrease its value to a considerable extent.

Speaking generally, the chief requirements of a steam coal are that it should have a high calorific value, kindle easily and burn freely. Hence coals of a semi-bituminous nature are in much demand for steam-producing.

The Admiralty require, for naval use, a steam coal having special characteristics, the chief of which are calorific efficiency, smokelessness, cleanness, hardness, free-burning properties, minimum of ash and clinker, and no tendency to cake or give trouble in stoking. Of these qualities, smokelessness is of the first importance. Anthracite possesses some of these qualities, but requires specially-constructed furnaces, and has other disadvantages for use in the Navy.

COKING COALS.

Only those coals which have the property of caking, and forming a residue of a sufficient degree of coherence, are suitable for the production of coke. It is not every coal which possesses these characteristics, and though various theories have

been put forward to explain this difference, it cannot be said that the matter is as yet properly understood. There is no simple relation between coking power and chemical composition, but it may be said that coals which are either very rich or very poor in hydrogen and oxygen, do not melt or cake. The coking property is probably determined by the presence in greater or less amount of certain compounds of carbon, hydrogen and oxygen, which at high temperatures are decomposed into volatile substances and carbon, the latter serving as a cement to bind the particles of the residue together. Another view (Donath) ascribes the variation in behaviour of different classes of coal when submitted to dry distillation, to differences in the structure of the carbon substance, and even to differences in the arrangement of the carbon atoms within the molecule. Thus the carbon molecule in coke is regarded as of different structure from the carbon molecule in wood charcoal. The caking power of coal is in some cases lost very soon after exposure to air, on account of the rapid weathering of the coal. With an increase in the quantity of ash, the caking power diminishes, and thus, although the coal substance may possess good caking properties, a good coke may not be produced if much foreign matter is present. In such cases, however, it is often possible to obtain a good coke by previous treatment of the coal. Thus, washing tests made in the St. Louis Laboratory of the U.S. Geological Survey, show that while the moisture increased by 10 to 30 per cent, the ash may be reduced by 20 to 60 per cent., and sulphur by 10 to 50 per cent.

Washed coking coal should not contain more than 6 per cent. ash and 7 per cent. water, and by careful treatment of a suitable coal, the ash may be reduced below this. It is sometimes profitable to use a mixture of coals for coking; thus a coal of high coke yield, but inferior caking power, may be mixed with a coal of low coke yield but good caking power, to produce a satisfactory yield of coke of good quality.

With regard to the influence of the composition of the ash, large amounts of silica, clay, and iron, hinder caking, while excess of lime promotes it, the coal particles becoming caked together by fusion of the ash.

The laboratory test for coke yield is not completely satisfactory, since the conditions are different from those in practice. It gives, however, a useful figure, generally a little too high, from which the coke yield may be inferred. A test for caking coals has recently been suggested, which may prove to be of value. The coal is powdered in an agate mortar until it will pass through a 100 mesh sieve, and the manner in which the coal adheres to the mortar is then examined. If it adheres strongly, the coal is said to have good caking powers, while if it does not adhere, its caking properties are probably small.

METALLURGICAL COKE.

While gas coke is a by-product, and hence any attempts to improve its quality or adaptability for special purposes are secondary to the production of gas; oven coke, on the other hand, is the primary product, and its quality is the first consideration. Metallurgical coke must be as free as possible from any impurities

which might have an injurious effect upon the metals in the making of which it is employed. Of these impurities the most important are sulphur and phosphorus, which, when the coke is used in the blast furnaces, would pass largely with the iron. Metallurgical coke is used for two main purposes, either for heating alone, as in cupola furnaces (foundry coke) or as both a heating and reducing agent for the reduction of metals from their ores (blast furnace coke). These two operations require cokes of different degrees of porosity, and in each case of a sufficient strength to withstand the attrition taking place in the furnace.

The power of resisting attrition depends on the strength of the walls of the pores of the coke, that is, on the strength of the coke substance itself, and also upon the density of the coke, since when the strength of the pore walls is the same, the denser the coke the less friable it will be, unless the larger pore spaces of the less dense coke have thicker walls.

The strength of metallurgical coke is important both from the point of view of transport, and because in the blast furnace a friable coke very readily breaks into small pieces which form dense masses with a part of the charge, and since the gases cannot penetrate them, interruptions occur.

The hardness of the pore walls depends upon the quality of the coal, the ash in the coke, especially silica in the ash, the temperature and width of the oven, and the duration of coking. The hardness of the coke appears to be related to the caking power of the coal, the more strongly caking coals giving the harder cokes. The presence of much silica in the ash appears to have an adverse effect on the hardness. The hardness of a coke may be measured by its resistance to pressure, and it appears that cokes will withstand pressure of from about 60 to about 175 kilos. per square centimetre.

Since in the blast furnace reducing gases are required, a porous coke is most suitable, because this will offer a large surface to the oxygen of the air, and facilitate the formation of carbon monoxide.

For foundry work, on the contrary, when the formation of reducing gases means loss of fuel and heat, the denser the coke the better, since the denser the coke the less the carbon surface exposed to the air, and complete combustion is thus facilitated.

It is evident, then, that besides the chemical composition, the hardness and porosity of coke must be considered for economical blast furnace or foundry use.

FUEL FOR MALTING PURPOSES.

Until the epidemic of arsenic poisoning in 1900, coke was largely used for malt kilns. It was subsequently pointed out that malt may be seriously contaminated with arsenic derived from the fuel used, and that coke, especially gas coke, was more liable to contain arsenic than good clean anthracite. It has been suggested that the arsenic would be retained in the coke by treating it with a base, such as lime, or would be prevented from passing over the malt by passing the furnace gases over

lime. It would seem safer, however, to use only a fuel which is itself free from arsenic, or practically so. Arsenic appears to be especially associated with the impurities found in coal, and more especially with the visible impurities, such as pyrites or coal brasses, and these should all be removed from anthracite used for malting purposes. Bands of slate or shale should also be removed, as well as obvious granular "black" pyrites. The extent to which coke may contain small amounts of arsenic, depends mainly upon the nature of the coking coal and the care taken to remove the pyrites and other impurities before the coking process. A process has recently been patented for the production of gas coke low in arsenic, the principle involving the volatilisation of the arsenic in the coal as chloride, by treating it with metallic chloride previous to coking. This process, so far as it has been used, appears to be successful, and should this experience be confirmed, will tend to provide cheaper fuel for malt kilns, and a wider market for gas coke.

COAL FOR GAS MANUFACTURE.

Good gas coal is generally rather brittle, and is made up of laminations which differ in their degree of brightness. It is usually of good caking power, and gives a hard compact coke. Some of the hard or splint coals give a good gas yield, but these do not, as a rule, give such a good coke as the best gas coals. Bright bituminous coals often give a large quantity of gas of good illuminating power, and a good coke. The cannel coals give a large yield of gas of high illuminating power, but, as a rule, these do not cake. There are slightly caking coals which are very similar to the cannels, but these rarely give the rich gas yield of the best non-caking cannels. It is not unusual to carbonise the Yorkshire, Midland and common gas coals in company with cannels.

The value of a gas coal depends primarily upon its yield of gas and illuminating power, but the yield and quality of the coke, the yield of tar and ammonia, the cost of purification, are all important factors which have to be taken into consideration.

It is well known that every coal, especially the richer class, requires its own appropriate temperature for economic distillation, and great variations in the gas yield, illuminating power, and the quantity and quality of the by-product, can be obtained by alteration of the temperature of distillation. The higher this temperature, the greater the yield of gas, but at the same time the illuminating power is decreased. At low distillation temperatures the tar is light and thin, containing chiefly paraffin and olefine hydrocarbons, while at high temperature the tar becomes thick, more benzenoid compounds are formed, with free carbon. At the same distillation temperature, cannels give a lighter tar than the common gas coals, but all coals may be made to produce a thick tar, by distilling them at a high temperature.

It will not be out of place here to give the relation between different standards of light used for the purpose of testing the illuminating power of gas. Mr. C. C. Paterson in the collected researches of the National Physical Laboratory 1908, gives

the following relative values of the three chief flame standards, as determined in Great Britain, France and Germany :—

	One-candle Pentane lamp.	Hefner-Alteneck Amyl-Acetate Lamp.	Carcel lamp.
National Physical Laboratory ...	1	0·914	0·982
Reichsanstalt	1	0·917	0·991
Laboratoire d'Essais	1	0·928	0·996
Laboratoire Central .:.......... ..	1	0·929	1
Average of the four returns	1	0·922	0·992

He arrives at the conclusion that the pentane and Hefner lamps are much more constant than the Carcel; that as between the Harcourt 10-candle pentane standard lamp and the Hefner lamp, the whiter light of the former and its greater power, viz., eleven times that of the latter, together with its greater ease of adjustment when making observations, greatly outweigh the advantages attaching to the Hefner lamp by reason of its simpler construction and the smaller correction required for changes in atmospheric pressure.

GASEOUS FUEL.

The use of producer gas and water gas when possible may result in a great saving of fuel, and these gases may also be used economically in internal-combustion engines for power production. Producer gas is formed by burning fuel in a column, the carbon dioxide formed at the seat of combustion becoming reduced to carbon monoxide by passing through a further thickness of heated fuel, the reaction being

$$C + CO_2 = 2\,CO.$$

Distillation products are also formed and mix with the carbon monoxide. On account of the air necessary for combustion, producer gas necessarily contains a considerable quantity of nitrogen. Thus some analyses of gas from the Wilson producer show about 56 per cent. of nitrogen and about 40 per cent. of combustible gas. Water gas is formed by the action of steam upon incandescent carbon, and consists of approximately equal volumes of carbon monoxide and hydrogen, the reaction being

$$C + H_2O = CO + H_2.$$

The different gas producers manufacture gases of various compositions, which may be considered as mixtures, in different proportions, of water gas and producer gas.

The St. Louis tests of the U.S. Geological Survey have shown that even low-grade coals (containing as much as 45 per cent. of ash), lignite and peats, high in moisture, can be successfully converted into producer gas for use in internal combustion engines. On an average it is estimated that when coal is used in a gas

producer $2\frac{1}{2}$ times as much power is developed as when the coal is used in the ordinary steam boiler plant. It would seem that there should be an increasing market for coal of inferior quality for use in gas producers and that considerable economies may be effected in this direction. In this country most producers are designed only for the use of anthracite or coke on account of the difficulty of dealing with the tar produced when bituminous coal is used. Numerous attempts have been made to avoid the formation of tar, but at present it is probable that it would hardly be possible to use economically highly bituminous coal or lignite in many of the gas producers in use in England.

BRIQUETTES.

The manufacture of satisfactory briquettes from small coal depends largely upon the use of a suitable binding material. The binding material should be cheap, bind strongly, and retain its binding qualities in the fire, be sufficiently waterproof to stand weather, should not cause smoke or increase the amount ot ash, and should not diminish the calorific power. Tests carried out at St. Louis on different binding agents showed that a large number of binding materials could be used. Pitch and tar from wood distillation, and rosin, gave briquettes which burnt well and stood the weather. Sulphite liquor and starch gave briquettes which burnt well without smoke, but would not stand the weather unless waterproofed. Coal tar and pitch were satisfactory, and it was found that the more soluble the tar and pitch in carbon disulphide the better it was as a briquetting material. The low boiling point oils, such as creosote, are unsuitable. Tar from gas producers and by-product coke ovens were also used with success. Crude petroleum is suggested as a waterproofing material.

These tests also point to the conclusion that many inferior bituminous coals and lignites may have their commercial value increased by briquetting to an extent which more than covers the cost of manufacture.

THE PURCHASE OF COAL.

Coal is one of the most important of raw materials, yet it is only recently that consumers have begun to realise the importance of buying it upon a scientific basis. Not only are the usual methods employed in its selection in some cases inadequate to obtain the best coal for the particular purpose in view, but having selected the coal, the steps taken to ensure that all deliveries shall be equal in quality to the sample selected—if, indeed, any steps are taken at all—are in many cases inefficient. When a fuel has been chosen, and a contract is to be drawn up for the supply, the consumer not infrequently considers that his interests are sufficiently protected by the insertion of a clause which provides that the deliveries shall be from the same colliery and the same seam as the trial sample. He would not, however, consider such a clause sufficient if he were buying iron or copper ores, as he would know that this would not ensure that the ore would always be of the same value. Quite apart

from possible variations in the seam of coal itself, and the fact that seams may become worked out, the amount of impurity in coal depends largely upon the care taken in removing by hand-picking, screening and washing, the slate, etc., which is mined with the coal, and hence upon the amount of supervision exercised at the colliery, which may vary from time to time.

It is therefore reasonable to substitute some more certain method of selecting a coal and checking the quality of the deliveries, and this can be done, as in the case of other raw material, by means of chemical tests. This method is now largely adopted in the United States of America, and sooner or later, fuel purchasers in this country will become aware of its advantages.

The value of coal as a fuel depends primarily upon its value as a heat producer. This depends not only on the composition of the coal substance, but also, as we have already seen, upon the amount of water and ash it contains. There are, of course, other factors to be considered, such as the amount of volatile matter, since coals containing much volatile matter can only be burned without waste in specially-constructed furnaces. The size of the coal has also to be considered, since dust and fine coal tend to check the draught, and uniformity of size is very desirable.

In the selection of a coal, therefore, it is necessary to consider the type of furnace, and conditions of firing, the classes of coal best suited to these conditions, the cost of handling the coal and ash, and the number of heat units which can be purchased per unit of price. Other conditions being equal, the value of coals of similar composition is proportional to their heating value, and here we have a basis upon which to establish a definite specification.

An obvious method would be to define certain limits within which the volatile matter, calorific value, ash, moisture and sulphur, must lie, and to reserve the right to reject any delivery which chemical tests showed to be outside these limits. The success of such a method would depend upon whether it was possible to obtain a sufficient supply of coal within the specification. To reject a delivery might involve the purchaser in loss due to inconvenience or delay, while if he accepts what is outside the specified limits he destroys the value of the contract.

While this is an undoubted advance upon a mere provision as to the seam and colliery from which the coal is to be obtained, it is obviously not so satisfactory as a method whereby a sliding scale is adopted. Under a sliding scale, a price is agreed upon for coal of a certain specification. Coal better or worse in quality than that indicated by the specification is accepted, however, provided that certain limits are not exceeded, and an adjustment in price is arranged, according as the coal is better or worse than the standard coal. Thus, if a better coal is supplied, the producer gets the benefit of a higher price, while, if the quality is lower, then the consumer pays less. If the scale is properly drawn up, the consumer pays only for what he gets, and the producer gets a proper price for all he sells. Thus, both sides reap a distinct benefit.

The purchase of coal under a sliding scale has been adopted by the Government of United States of America, and a specimen of the specification is of sufficient interest to be given here in full.

SPECIFICATIONS AND PROPOSALS FOR SUPPLYING COAL.

United States..................................

....190...

PROPOSAL.

Sealed proposals will be received at this office until 2 o'clock p.m., ...190..., for supplying coal to the United States .... building at .... as follows :—

The quantity of coal stated above is based upon the previous annual consumption, and proposals must be made upon the basis of a delivery of 10 per cent. more or less than this amount, subject to the actual requirements of the service.

Proposals must be made on this form, and include all expenses incident to the delivery and stowage of the coal, which must be delivered in such quantities and at such times within the fiscal year ending June 30, 190..., as may be required.

Proposals must be accompanied by a deposit (certified check, when practicable, in favour of ....), amounting to 10 per cent. of the aggregate amount of the bid submitted, as a guaranty that it is *bona fide*. Deposits will be returned to unsuccessful bidders immediately after award has been made, but the deposit of the successful bidder will be retained until after the coal shall have been delivered and final settlement made therefor, as security for the faithful performance of the terms of the contract, with the understanding that the whole or a part thereof may be used to liquidate the value of any deficiencies in quality or delivery that may arise under the terms of the contract.

When the amount of the contract exceeds 10,000 dols., a bond may be executed in the sum of 25 per cent. of the contract amount, and in this case the deposit or certified check submitted with the proposal will be returned after approval of the bond.

The bids will be opened in the presence of the bidders, their representatives, or such of them as may attend, at the time and place above specified.

In determining the award of the contract, consideration will be given to the quality of the coal offered by the bidder, as well as the price per ton, and should it appear to be to the best interests of the Government to award the contract for supplying coal at a price higher than that named in lower bid or bids received, the award will be so made.

The right to reject any or all bids and to waive defects is expressly reserved by the Government.

Description of Coal Desired.*

Bids are desired on coal described as follows :—

Coals containing more than the following percentages based upon dry coal, will not be considered :—

Ash	...... per cent.
Volatile matter	...... per cent.
Sulphur	...... per cent.
Dust and fine coal as delivered at point of consumption †...............................	...... per cent.

Delivery.

The coal shall be delivered in such quantities and at such times as the Government may direct.

In this connection it may be stated that all the available storage capacity of the coal bunkers will be placed at the disposal of the contractor to facilitate delivery of coal under favourable conditions.

After verbal or written notice has been given to deliver coal under this contract, a further notice may be served in writing upon the contractor to make delivery of the coal so ordered within twenty-four hours after receipt of said second notice.

Should the contractor, for any reason, fail to comply with the second request, the Government will be at liberty to buy coal in the open market, and to charge against the contractor any excess in price of coal so purchased over the contract price.

Sampling.

Samples of the coal delivered will be taken by a representative of the Government.

In all cases where it is practicable, the coal will be sampled at the time it is being delivered to the building. In case of small deliveries, it may be necessary to take these samples from the yards or bins. The sample taken will in no case be less than the total of 100 lb., to be selected proportionally from the lumps and fine coal, in order that it will in every respect truly represent the quality of the whole bulk of coal under consideration.

In order to minimise the loss in the original moisture content the gross sample will be pulverised as rapidly as possible until none of the fragments exceed one-half inch in diameter. The fine coal will then be mixed thoroughly and divided into four equal parts. Opposite quarters will be thrown out, and the remaining portions thoroughly mixed and again quartered, throwing out opposite quarters as before. This process will be continued as rapidly as possible until the final sample is reduced to such amount that all of the final sample thus obtained will be contained in the shipping can or jar and sealed air-tight.

The sample will then be forwarded to

* This information will be given by the Government as may be determined by boiler and furnace equipment, operating conditions, and the local market.

† All coal which will pass through a $\frac{1}{8}$ in. round hole screen.

If desired by the coal contractor, permission will be given to him, or his representative, to be present and witness the quartering and preparation of the final sample to be forwarded to the Government laboratories.

Immediately on receipt of the sample, it will be analysed and tested by the Government, following the method adopted by the American Chemical Society and using a bomb calorimeter. A copy of the result will be mailed to the contractor upon the completion thereof.

Causes for Rejection.

A contract entered into under the terms of this specification shall not be binding if, as the result of a practical service test of reasonable duration, the coal fails to give satisfactory results owing to excessive clinkering or to a prohibitive amount of smoke.

It is understood that the coal delivered during the year will be of the same character as that specified by the contractor. It should, therefore, be supplied, as nearly as possible, from the same mine or group of mines.

Coal containing percentages of volatile matter, sulphur and dust higher than the limits indicated on page xii, and coal containing a percentage of ash in excess of the maximum limits indicated in the following table will be subject to rejection.

In the case of coal which has been delivered and used for trial, or which has been consumed or remains on the premises at the time of the determination of its quality, payment will be made therefor at a reduced price, computed under the terms of this specification.

Occasional deliveries containing ash up to the percentage indicated in the column of "Maximum limits for ash," on page xiv, may be accepted. Frequent or continued failure to maintain the standard established by the contractor, however, will be considered sufficient cause for cancellation of the contract.

Price and Payment.*

Payment will be made on the basis of the price named in the proposal for the coal specified therein, corrected for variations in heating value and ash, as shown by analysis, above and below the standard established by contractor in this proposal. For example, if the coal contains 2 per cent., more or less, British thermal units than the established standard, the price will be increased or decreased 2 per cent. accordingly.

The price will also be further corrected for the percentages of ash. For all coal which by analysis contains less ash than that established in this proposal a premium of 1 cent per ton for each whole per cent. less ash will be paid. An increase in the ash content of 2 per cent. over the standard established by contractor will be tolerated without exacting a penalty for the excess of ash. When such excess exceeds 2 per cent. above the standard established, deductions will be made from price paid per ton in accordance with following table :—

* The economic value of a fuel is affected by the actual amount of combustible matter it contains, as determined by its heating value shown in British thermal units per pound of fuel, and also by other factors, among which is its ash content. The ash content not only lowers the heating value and decreases the capacity of the furnace, but also materially increases the cost of handling the coal, the labour of firing, and the cost of the removal of ashes, &c.

Ash as established in proposal (per cent.)	No deduction for limits below	Cents per ton to be deducted. 2	4	7	12	18	25	35	Maximum limits for ash.
		Percentages of ash in dry coal.							
5	7	7- 8	8- 9	9-10	10-11	11-12	12-13	13-14	12
6	8	8- 9	9-10	10-11	11-12	12-13	13-14	14-15	13
7	9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	14
8	10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	14
9	11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	15
10	12	12-13	13-14	14-15	15-16	16-17	17-18		16
11	13	13-14	14-15	15-16	16-17	17-18	18-19		16
12	14	14-15	15-16	16-17	17-18	18-19	19-20		17
13	15	15-16	16-17	17-18	18-19	19-20	20-21		18
14	16	16-17	17-18	18-19	19-20	20-21	21-22		19
15	17	17-18	18-19	19-20	20-21	21-22			19
16	18	18-19	19-20	20-21	21-22	22-23			20
17	19	19-20	20-21	21-22	22-23				21
18	20	20-21	21-22	22-23					22

Proposals to receive consideration must be submitted upon this form and contain all the information requested.

....

...., 190...

The undersigned hereby agree to furnish to the U.S.................................. ..building at ...., the coal described, in tons of 2,240 lb. each, and in quantity 10 per cent. more or less than that stated under the head of "Delivery," as may be required during the fiscal year ending June 30, 190..., in strict accordance with this specification; the coal to be delivered in such quantities and at such times as the Government may direct.

Description.	Item No ...	Item No....	Item No....
Commercial name			
Name of mine			
Location of mine.................			
Name of coal bed			
Size of coal (if coal is screened) :—			
Coal to pass through openings......	inches (round) (square)	inches (round) (square)	inches (round) (square)
Coal to pass over openings	inches (bar)	inches (bar)	inches (bar)
Data to establish a basis for payment			
Per cent. of ash in dry coal (method of American Chemical Society) ...			
British thermal units in coal as delivered			
Price per ton (2,240 lb.)..................			

It is important that the above information does not establish higher standard than can be actually maintained under the terms of the contract; and in this connection it should be noted that the small samples taken from the mine are invariably of higher quality than the coal actually delivered therefrom. It is evident, therefore, that it will be to the best interests of the contractor to furnish a correct description with average values of the coal offered, as a failure to maintain the standard established by contractor will result in deductions from the contract price, and may cause a cancellation of the contract, while deliveries of a coal of higher grade than quoted will be paid for at an increased price.

Signature ....

Address.. ....

Name of corporation...

Name of president ....

Name of secretary... ...

Under what law (State) corporation is organised........................... ....

It will be seen that a sample of coal is not submitted for approval, but the coal merchant is expected to state the thermal value of the coal as it will be delivered, and this value is the basis of the purchase. Since the thermal value is determined on the coal as delivered, no correction for moisture is necessary. How this works in practice is best shown by an example, in which, for convenience, English money will be substituted. Suppose a contractor agrees to supply coal containing 5 per

cent. ash, and of calorific power 13,000 B.T.U. at the price of 8s. 4d. per ton. If a delivery on analysis shows the ash to be 3 per cent., and calorific value 13,130, an increased price will be paid. The calorific value being 1 per cent. higher will mean an increase in price of 1 per cent. = 1d. per ton, and the ash being 2 per cent. lower will also bring an increase in price of 1d. per ton. This delivery will, therefore, be paid for at the rate of 8s. 6d. per ton. A future delivery, on the other hand, may show 9 per cent. of ash and only 12,740 B.T.U. This contains 2 per cent. more ash than the specified free limit of 7 per cent. as shown by the table, and hence the price will be reduced by 2d. per ton. The calorific value is 2 per cent. lower, and this will reduce the price also by 2d. Hence this delivery will be paid for at the rate of 8s. per ton.

Another form of purchase adopted by a large firm in Chicago is shown by the following form of contract :—

I. The company agrees to furnish and deliver to the consumer......... ....at such times and in such quantities as ordered by the consumer for consumption at said premises during the term hereof, at the consumer's option, either or all of the kinds of coal described below, said coals to average the following assays :—

Kind of coal			
Of size passing through screen having circular perforations in diameter	......inches	......inches	..... inches
Of size passing over a screen having circular perforations in diameter	......inches	......inches	......inches
Per cent. of moisture in coal as delivered			
Per cent. of ash in coal as delivered			
British thermal units per pound of dry coal ...			
From following county			
From following State......................................			

Coal of the above respective descriptions and specified assays (not average assays) to be hereinafter known as the contract grade of the respective kinds.

II. The consumer agrees to purchase from the company all the coal required for consumption at said premises during the term of said contract, except as set forth in Paragraph III. below, and to pay the company for each ton of 2,000 lb.* avoirdupois of coal delivered and accepted in accordance with all the terms of this contract at the following contract rate per ton for coal of each respective contract grade, at which rates the company will deliver the following respective numbers of British thermal units for 1 cent, the contract guaranty.

Kind of coal.	Contract rate per ton.	Contract guaranty.
	$ equal to	net B.T.U. for 1 cent
	$ equal to	net B.T.U. for 1 cent
	$ equal to	net B.T.U. for 1 cent

Said net British thermal units for 1 cent being in each case determined as follows :— Multiply the number of British thermal units per pound of dry coal by the per cent. of moisture (expressed in decimals†), subtract the product so found from the number of British

* In the United States both long tons (2,240 lb.) and short tons (2,000 lb.) are used, the former mainly in the anthracite market.

† *i.e.* The percentage figure divided by 100.

thermal units per pound of dry coal, multiply the remainder by 2,000, and divide this product by the contract rate per ton (expressed in cents), plus one-half of the ash percentage expressed as cents).

III. It is provided that the consumer may purchase for consumption at said premises coal other than herein contracted for, for test purposes, it being understood that the total of such coal so purchased shall not exceed 5 per cent. of the total consumption during the term of this contract.

IV. It is understood that the company may deliver coal hereunder containing as high as 3 per cent. more ash and as high as 3 per cent. more moisture, and as low as 500 fewer British thermal units per pound dry than specified above for contract grades.

V. Should any coal delivered hereunder contain more than the per cent. of ash or moisture or fewer than the number of British thermal units per pound dry allowed under Paragraph IV. hereof, the consumer may, at its option, either accept or reject same.

VI. All coal accepted hereunder shall be paid for monthly at a price per ton determined by taking the average of the delivered values obtained from the analyses of all the samples taken during that month, said delivered value in each case being obtained as follows:—Multiply the number of British thermal units delivered per pound of dry coal by the per cent. of moisture delivered (expressed in decimals), subtract the product so found from the number of British thermal units delivered per pound of dry coal, multiply the remainder by 2,000, divide this product by the contract guaranty, and from this quotient (expressed as dollars and cents) subtract one-half of the ash percentage delivered (expressed in cents).

It will be noticed that the essential point is that the price paid for the coal shall be such that the number of B.T.U. bought for one halfpenny shall always be the same. Further that since the thermal value is determined on the dry coal, an allowance is made for moisture. Suppose the coal specified to contain ash 5 per cent., calorific value 13,000, and 5 per cent. of moisture, the price to be 8s. 4d. per ton. Using the ton of 2,000 lb.* and calculating by the method laid down, we find that one halfpenny will purchase

$$\frac{13{,}000 - 650}{200 + 2{\cdot}5} \times 2{,}000 \text{ B.T.U.}$$
$$= \frac{12{,}350 \times 2{,}000}{202{\cdot}5}$$
$$= 121{,}970 \text{ B.T.U. per halfpenny.}$$

The first delivery, which showed ash 3 per cent., calorific value 13,130, and 4 per cent. of moisture, would have its price calculated thus:—

$$\frac{(13{,}130 - 525) \times 2{,}000}{121{,}970} - 1{\cdot}5$$
$$= \frac{12{,}605 \times 2{,}000}{121{,}970} - 1{\cdot}5$$
$$= 206{\cdot}7 - 1{\cdot}5$$
$$= 205{\cdot}2 \text{ halfpence}$$
$$= 8\text{s. } 6\tfrac{1}{2}\text{d. per short ton.}$$

* See footnote, p. xvi.

Suppose the second delivery to show calorific value 12,740, ash 8 per cent., moisture 7 per cent. The price of this would be :—

$$\frac{(12{,}740 - 892) \times 2{,}000}{121{,}970} - 4$$
$$= \frac{11{,}848 \times 2{,}000}{121{,}970} - 4$$
$$= 194 \cdot 27 - 4$$
$$= 190 \cdot 27 \text{ halfpence}$$
$$= 7s.\ 11\tfrac{1}{4}d. \text{ per short ton.}$$

These examples will be sufficient to show the principle involved, and how coal purchased on these lines works out in practice. In the United States of America, these or similar methods are widely employed, and the advantage, both to the colliery owners and consumers, is recognised. In England, but little progress has been made in this direction, though some attempt has been made to purchase fuel on a sliding scale, with the calorific value as a basis.

It is obvious that any such method will depend for its success upon accurate sampling and testing, and the possibility of this being done by a disinterested party, for since both the buyer and seller are interested parties, the samples taken and tests made by either would always be liable to be disputed by the other. This difficulty has been met in America, in a most satisfactory manner, by the Fuel Engineering Company, of Chicago, an organisation which undertakes the sampling and testing of fuel with special reference to its supply under guarantee. There is no doubt that were there a demand for it, a similar organisation would be established in England, or a properly qualified analyst could be agreed upon by both parties, who would superintend the sampling and make the necessary tests, and whose decision should be accepted as final. The Government fuel-testing department in Switzerland performs a somewhat similar office.

The principle of purchasing coal by its calorific value has already been adopted by certain municipal authorities in this country. The St. Pancras Borough Electrical Department has in its coal specification the following clauses :—

Tender should state clearly for each coal :

(1) Pit or seam from which the coal will be obtained.

(2) Calorific value in British heat units. This figure must be given by the colliery manager.

(3) Percentage of ash as given by the colliery manager. The colliery manager or owner must certify the accuracy of (1), (2), (3).

The contractor must be prepared to guarantee that the calorific value shall be maintained as stated in the tender, and that the percentage of ash shall not be exceeded. The Borough Council will, from time to time, test samples of the coal supplied, and the average of the week's test will be recorded; and should it be found that the quality does not comply with the values stated, the Borough Council shall have power to deduct such moneys from the next account as they may deem fair and reasonable, by way of compensation for such losses incurred.

The above clause, however, does not quite cover the point. Another municipal electric lighting engineer of one of the London boroughs has in his contract form a clause stipulating that tests shall be made weekly from samples taken of the fuel delivered during the week, and that, if the mean of any four tests during any month shows that the calorific value is below the standard (in this case 13,300 British thermal units), the rate paid to the contractor shall be less than the contract price by 5d. per ton for each deficiency of 100 British thermal units. Should the average of the fuel in any month thus lie between 13,000 and 13,100 B.T.U., the price will be reduced by 1s. 3d. per ton. With respect to this clause it is obviously one-sided, since there is no provision for payment of a higher price per ton if the calorific value exceed the standard. Furthermore, unless other clauses are inserted respecting allowances to be made for ash and moisture content, the contract form is unsatisfactory both from the buyer's and seller's point of view.

One of the chief objections made by colliery owners to the system under discussion, is that owing to the natural variability of coalseams it is not possible to guarantee the calorific value. This, however, is not required. All that is demanded by the American system is that the purchaser shall pay a specified amount for each unit of heat the coal is capable of yielding in an ordinary calorimetric test. So that the colliery owner would, other things being equal, receive more for a coal with a high calorific power than for one with a low one. There is no question of guaranteeing any specified calorific value, except within, of course, certain limits. Neither is there any question of the steam-raising quality of the coal when burnt in any particular plant. That is for the consumer to take care of. Having paid for and received so many units of potential heat, the wise consumer will dispose of them to the best advantage.

A more serious objection to the system of purchase of coal by calorific power is the question of the middleman. It is much easier to apply this system in purchasing direct from the collieries than in dealing with the coal merchant. There are many large consumers who adhere to the practice of getting in daily or weekly supplies at the lowest current prices. In such cases there would be practical difficulties in the way of getting every consignment sampled and tested.

Apart from this difficulty of procedure, success would depend upon the consumer knowing exactly the class of coal best suited to his needs, the seller knowing the average quality of his coal, and the sliding scale being drawn up with skill and impartiality. If the consumer did not know the class of coal he required, he would not be able to take advantage of the opportunity afforded to obtain it, and while obtaining an excellent fuel at a fair price, might find it unsuitable. If the seller did not know the average quality of his coal, he might agree to supply coal of a higher quality than he was able and thus find himself continually penalised under the sliding scale. Finally the sliding scale should be drawn up having regard to what the consumer may reasonably expect to obtain, and the seller may be reasonably expected to produce.

THE MEANING AND INTERPRETATION OF ANALYSES.

It is customary to give two sets of numbers for the analysis of coal, one of which is called the proximate, and the other the ultimate analysis. It is only the latter which can properly be called an analysis, since this gives the proportions in which the chemical elements are present, and these do not vary in a given sample of coal. On the other hand, the proximate analysis, which gives the "volatile matter" and "coke" does not deal with any constant constituents of the coal, since widely different results may be obtained by using different methods of obtaining the figures. This is because the manner in which coal is broken down by heat depends upon the rate at which heat is applied, and the temperature to which it is raised. N. W. Lord states that the volatile matter determination is affected not only by the method of heating the sample of coal, but also by the fineness to which the sample is pulverised and by the amount of loosely-held water which is present. In the case of bituminous coals, the differences due to different methods of procedure do not exceed 3 to 4 per per cent., which is mainly due to the different way in which the hydrocarbon compounds break up. In the case of lignites, the differences may amount to as much as 25 per cent., being due largely to mechanical loss. Hence, in order that the proximate analyses of a number of coals may be comparable, it is necessary that the same method should have been used in each case.

Under the heading of proximate analysis, one finds given the percentage of volatile matter, fixed carbon and ash. In some cases the terms "volatile combustible matter" or "volatile hydrocarbons" are used in place of "volatile matter," but the last is much to be preferred, since the decomposition products contain a variable proportion of water, and other non-combustible gases. The term "fixed carbon," which is commonly given to the residue after expelling the volatile matter and deducting the ash, is also misleading, since the ash-free residue does not, by any means, consist of pure carbon, but usually contains, in addition, appreciable quantities of oxygen, nitrogen, sulphur and hydrogen.

The amount of "ash" probably never gives accurately the mineral matter present in the coal. A variable amount of sulphur remains in the ash, depending upon the method of determination. If carbonate of lime is present, most of the carbon dioxide will be driven off, and if hydrated minerals are present which do not yield up their water at the temperature at which the coal is dried, there will be loss from this source. As a general rule, the ash as determined by combustion in oxygen is higher than that obtained in air, as in a muffle.

The ash of coal is derived partly from the organic matter of which coal is composed, and partly from clay and other incombustible matter enclosed within the coal when it was deposited. While a certain amount of ash is therefore necessarily present, it must not be forgotten that ash diminishes the calorific value of coal for two reasons. In the first place the more mineral matter, the less combustible matter will be present, and in the second place, a certain amount of heat will be

used up in raising the temperature of the ash. Further, a great amount of ash will tend to reduce the draught and render the coal more difficult to burn completely, so that there will be a greater waste of actual combustible matter.

The ash of coal consists usually of silica and alumina, associated with compounds of iron, magnesium, calcium, and the alkali metals. It generally contains also a little phosphate and sulphate. The composition of the ash is sometimes of importance, as from it it is possible to determine its fusibility or its tendency to clinker on the furnace bars. The fusibility increases as the proportion of iron oxide, lime and magnesia rises in relation to the aluminium silicate. E. Prost has given a method by which the fusibility may be calculated from the analytical results.

Let S=oxygen content of the silica. A=oxygen content of the alumina, and B=oxygen content of the iron oxide, lime and magnesia. Then $\frac{A^2}{B \times S} = Q$ where Q varies as the infusibility of the ash.

If Q exceeds 2·5, and iron oxide is less than 7 per cent., the ash will stand a temperature of 1,500 degs. Cent.

If Q is about 1·6, the ash will fuse at about 1,350 degs. Cent., but Q may exceed 2·25 if the iron oxide is greater than 7 per cent.

If Q is less than 1·6 the ash will fuse below 1,350 degs. Cent.

As an example consider an ash of the following composition :—

SiO_2	49·46	oxygen content =	26·37
Al_2O_3	33·28	,, ,,	15·66
Fe_2O_3	5·50	,, ,,	1·65
CaO	2·76	,, ,,	0·78
MgO	0·78	,, ,,	0·32

Here we have S = 26·37 A = 15·66

$$B = (1{\cdot}65 + 0{\cdot}78 + 0{\cdot}32)$$
$$= 2{\cdot}75$$

Substituting these values in the equation given above, we have

$$Q = \frac{(15{\cdot}66)^2}{2{\cdot}75 \times 26{\cdot}37}$$
$$= \frac{245{\cdot}23}{72{\cdot}52}$$
$$= 3{\cdot}38$$

whence it may be inferred that the ash will stand a temperature of 1,500 degs. Cent.

By moisture is generally understood the water which is present as such in the coal. As has been mentioned, water may be formed when coal is stongly heated, but in this case it is produced by the decomposition of the coal, and is not present as such in the original sample. The water originally present can be removed either by heating to a temperature of 105 degs. Cent. or by drying in a vacuum over sulphuric acid. The latter method gives, as a rule, a higher result by about 0·3 per cent. The former method is probably in most general use. Unless special precautions are taken, the moisture figure will not represent the amount of water in the original sample, because in the process of sampling and powdering which is

necessary in the preparation of a sample for analysis, moisture may either be lost or gained according as the original sample contained much or little, and the air at the time of sampling was dry or moist. In some cases it may also depend upon the nature of the coal. In the majority of cases there is probably a loss of moisture during the sampling process, and this will be greater according as the original sample contains more moisture. Hence the moisture determination on the powdered sample will be too low, and in order to obtain a closer approximation to the true percentage of moisture in the coal a determination must be made upon the coarsely broken sample.

Since the amount of moisture in coal is variable, it is desirable to perform the analysis on the dry coal, stating the moisture percentage separately.

An excessive amount of moisture is undesirable, not only because it is a diluent and expensive at the price of coal, but because it will absorb heat in its evaporation. From this point of view it is more objectionable than ash. An example will make this clear. Suppose the calorific value of a sample of coal to be 14,000 B.T.U. per pound on the dry coal, and suppose the coal as delivered to contain 10 per cent. of moisture. Then each pound of fuel as delivered will contain 0·9 lb. of coal and 0·1 lb. of water. The calorific value of the fuel will be 14,000 × 0·9, or 12,600 B.T.U. Further, 0·1 lb. of water has to be raised to 212 degs. Fahr. from, say, 60 degs. Fahr. and converted into steam. To raise 0·1 lb. of water from 60 degs. to 212 degs. Fahr., or through 152 degs. Fahr. requires 15·2 B.T.U., and to evaporate 0·1 lb. water at 212 degs. Fahr. to steam at 212 degs. Fahr., requires 96·6 B.T.U., so that (96·6 + 15·2) = 122 B.T.U. will be absorbed by the water in the coal.

Hence the calorific value of the fuel as delivered will be 12,600 − 122 = 12,478 B.T.U., which is considerably less than that of the dry fuel.

The determinations comprising the ultimate analysis are quite definite and not liable to any errors other than those of analysis, and these in competent hands are very small. The percentage of carbon is the total carbon, which includes both the fixed carbon of the proximate analysis, and the carbon contained in the volatile matter. If carbonates are present in the coal, then part or all of the carbon of the carbonic acid will be included in the total carbon, which will therefore be too high. The carbon of carbonic acid, being already fully oxidised, and therefore incombustible, has no value for heating purposes.

The hydrogen represents the total hydrogen in the dry coal. Only that which is in excess of the amount required to form water with the oxygen present in the coal is regarded as available as a source of heat. This has been termed "disposable" hydrogen.

Nitrogen is very generally present in coals. Free nitrogen is derived mainly from access of air, and in part from nitrogen compounds, such as albuminoid or proteid bodies associated with the cellulose, and from animal remains in the coal.

Fixed nitrogen varies from 0·4 to 2·5 per cent. Except that it acts as a diluent, nitrogen is chiefly of importance from the point of view of by-products in the manufacture of coke and gas. Part of the nitrogen remains in the coke, and part goes to form ammonia and cyanogen compounds, the amount remaining in the coke depending to some extent upon the method of heating. The more rapidly the coking process is conducted, the more nitrogen will be retained by the coke.

Oxygen is determined by difference and will thus bear all the accumulated errors of analysis. These may or may not balance, and this figure must be regarded as the least reliable of those given in the ultimate analysis.

Sulphur probably has its origin in the plant substances from which the coal was formed. It may occur in coal, either as pyrites, as sulphate, such as sulphate of lime, or combined with the organic constituents of the coal. Sulphur is objectionable for most purposes, since, when the coal is burned, the sulphur burns with the formation of strongly acid oxides of sulphur, which may rapidly destroy furnace bars, boiler tubes and any metal work with which the fumes come into contact. Further, a high sulphur percentage not infrequently corresponds with much iron in the ash, on account of its presence in the coal as pyrites, and thus it may indicate an ash which has a tendency to clinker. Sulphur is also objectionable in coal or coke used for metallurgical purposes. In the blast furnace it may cause brittleness in the iron. If the sulphur passes into slags as sulphide, the fluxing effect is diminished.

Phosphorus, derived from the vegetable matter from which the coal was formed, is sometimes present in amounts which are detrimental to the use of fuel for blast furnace work. Any phosphorus in the coal remains in the coke manufactured from it, and since this element diminishes the tenacity and elasticity of iron, the amount of it is of importance with regard to iron smelting. This point is of less moment since the introduction of the basic process.

Arsenic has long been known to be occasionally present in coal, but its presence was only regarded as of importance when in 1900 there occurred an epidemic of arsenic poisoning due to the presence of small quantities of arsenic in beer. The Royal Commission which was appointed to enquire into the causes of this epidemic established the fact of the frequent occurrence of traces of arsenic in fuel used in the malting kiln, and hence the presence or absence of arsenic in anthracite or coke used for the purpose is of importance. The arsenic appears to be derived mainly from the pyrites or "brasses," and also from granular black bands which appear intermittently or constantly at certain levels in the seams. Clean South Wales anthracites as a class are more free from arsenic than either gas coke or oven coke.

The majority of the samples of clean anthracite examined for the Royal Commission on Arsenical Poisoning contained not more than ten parts per million of arsenic. Oven coke, as a rule, is more free from arsenic than gas coke, but this is by no means invariably the case.

THE CALORIFIC VALUE OF COAL.

The calorific power of coal is expressed as the number of units of heat evolved by the complete combustion of unit weight of coal. Heat is measured by the number of units of weight of water raised through a definite degree of temperature. There are four units of heat in common use:—

1. The *gramme calorie*, which is the quantity of heat necessary to raise 1 gramme of water through 1 deg. Cent.

2. The *kilogramme calorie*, which is the quantity of heat necessary to raise 1 kilogramme of water through 1 deg. Cent, and is thus 1,000 times greater than the gramme calorie.

3. The *Centigrade thermal unit*, which is the quantity of heat necessary to raise 1 lb. of water through 1 deg. Cent. This is commonly called the pound Centigrade unit.

4. The *British thermal unit*, which is the quantity of heat necessary to raise 1 lb. of water through 1 deg. Fahr.

There is a definite relation between these units of heat, as shown by the following table:—

1 kilogramme calorie	= 1,000 gramme calorie.
	= 2·2046 Centigrade thermal units.
	= 3·9683 British thermal units.
1 Centigrade thermal unit	= 0·4536 kilogramme calorie.
	= 1·8 British thermal units.
1 British thermal unit	= 0·2520 kilogramme calorie.
	= 0·5555 Centigrade thermal unit.

It is necessary to note, however, that the numerical value of the calorific power will be the same whether it is expressed in gramme calories, kilogramme calories, or Centigrade thermal units, provided that the weight of fuel considered to have been used is stated as a gramme, a kilogramme, or a pound, respectively. That this is the case will be obvious from the following considerations. Suppose the calorific value of a coal is given as 7,000 gramme calories. This means that on burning 1 gramme of coal, sufficient heat will be evolved to raise 7,000 grammes of water through 1 deg. Cent. A kilogramme of the coal would evolve 1,000 times as much heat, and would therefore raise 7,000 × 1,000 grammes, or 7,000 kilogs. of water through 1 deg. Cent.—that is, would evolve 7,000 kilogramme calories. And since 1 lb. = 453·59 grammes, on burning 1 lb. of the coal 453·59 times as much heat would be evolved as when burning 1 gramme, and this would be sufficient to raise 453·59 × 7,000 grammes of water through 1 deg. Cent. But 453·59 × 7,000 grammes is equal to 7,000 lb., and 7,000 lb. of water raised through 1 deg. Cent. require 7,000 Centigrade thermal units. When we change from Centigrade to Fahrenheit degrees, however, the case is different. Hence, if the value is given in either of the Centigrade units and it is required to convert it into British thermal units, it is only necessary to multiply by 1·8, or if the reverse is required the value in British thermal units is multiplied by 0·5555.

The theoretical evaporative power can also be calculated from the calorific power. This is the weight of water at 100 degs. Cent. or 212 degs. Fahr. converted into steam at the same temperature by a definite weight of coal, usually 1 lb. As is well known, when water is converted into steam a certain amount of heat is absorbed, or rendered "latent," without the sensible temperature being raised. Thus, when 1 lb. of water at 100 degs. Cent. is converted into steam at 100 degs. Cent., 536·6 Centigrade thermal units are rendered latent. Hence, if the calorific value is expressed in Centigrade units, the evaporative power may be obtained by dividing the calorific value by 536·6. If British thermal units are used, the latent heat of steam is 965·88, and the calorific power in these units is divided by this number in order to obtain the evaporative power. Thus the evaporative power of a coal, the calorific value of which is 8,303 Centigrade units, or 14,945 British thermal units, will be

$$\frac{8,303}{536{\cdot}6} = \frac{14,945}{965{\cdot}88} = 15{\cdot}47 \text{ lb.}$$

It is hardly necessary to remark that the theoretical evaporative power is never realised in practice, since it assumes the complete combustion of the fuel and the transference of all the heat evolved to the water in the boiler.

The calorific power of coal is usually determined experimentally in some form of calorimeter, the Lewis Thompson, or one of its modifications, being in most general use, although probably greater accuracy would be obtained by some form of bomb calorimeter such as that of Mahler. (undoubted)

The calorific value can also be calculated from either the ultimate analysis or the proximate assay, and in many cases calculation gives results sufficiently near the truth for practical purposes. It is stated that the calorific value obtained by calculation from the ultimate analysis is often in very close agreement with that obtained experimentally with a bomb calorimeter. The calculation is based on the assumption that the heat of combustion of a compound is the sum of the heats of combustion of its constituents.

Carbon in its different modifications, such as diamond, graphite and charcoal, has slightly different heats of combustion. In the form of charcoal, the heat of combustion is 96,980 calories, or, expressed in the form of an equation,

$$C + O_2 = CO_2 + 96,980 \text{ calories.}$$

This means that 12 grammes of carbon, when burnt to carbon dioxide, evolve 96,980 calories, whence 1 gramme of carbon will evolve

$$\frac{96,980}{12} \text{ or } 8,081{\cdot}7 \text{ calories.}$$

Similarly, it has been found that the heat of combustion of 1 gramme of hydrogen to form water is 34,460 calories, and of sulphur 2,250.

When a carbon compound contains oxygen, "Welter's rule" is applied, by which the oxygen is subtracted, together with as much hydrogen as will suffice to

convert it completely into water, and the heat of combustion of the residue gives an approximation to the heat of combustion of the whole compound.

These principles have been applied in Dulong's formula for calculating the calorific value from the percentage composition of the coal. This is

$$Q = \frac{1}{100}(8{,}080\ C + 34{,}460\ (H - \tfrac{1}{8}O) + 2{,}250\ S)$$

when C = percentage of carbon, H = percentage of hydrogen, O = percentage of oxygen, S = percentage of sulphur.

It will be seen that Q, the calorific power, is simply the sum of the heats of combustion of the carbon, sulphur and the excess of hydrogen above that which is required to form water with the oxygen present, divided by 100. The reason for dividing by 100 is that, calculated on the percentage composition, the calorific power is given for 100 parts of coal, and it is usual to express it for one part.

As an example, the calorific value of the following coal may be calculated :—

	Per cent.
Carbon	82·05
Hydrogen	4·78
Oxygen	9·32
Nitrogen	1·02
Sulphur	0·78
Ash	2·05
	100·00

	Per cent.
Volatile matter	37·70
Fixed carbon	60·25
Ash	2·05
	100·00
Moisture	6·40

Calorific power (calorimeter), 8,003 calories.

Here we have

$$H - \tfrac{1}{8}O = 4{\cdot}78 - \frac{9{\cdot}32}{8} = 3{\cdot}62$$

$$\begin{aligned} 8{,}080 \times 82{\cdot}05 &= 662{,}965 \\ 34{,}460 \times 3{\cdot}62 &= 124{,}745 \\ 2{,}250 \times 0{\cdot}78 &= 1{,}755 \\ & \overline{789{,}465} \end{aligned}$$

and, dividing by 100, Q = 7,895 calories, which is 108 calories lower than the experimental result.

There are several formulæ for the calculation of calorific power from the proximate analysis. That of F. Haas is

$$Q = \frac{1}{100}[8{,}710\ (100 - [A + S + \text{moisture}]) + 2{,}250\ S]$$

when A = percentage of ash, the notation being otherwise the same as employed above. It will be noticed that this assumes that the residue, after subtracting ash, sulphur and moisture, has a constant heat of combustion. This, of course, is not the case, as it will vary with the relative amount of carbon, hydrogen, and oxygen which it contains. The calorific power of the dry coal given above, from this formula, will be

$$\frac{1}{100}[8{,}710\ (100 - [2{\cdot}05 + 0{\cdot}78]) + 2{,}250 \times 0{\cdot}78$$
$$= \frac{1}{100}[8{,}710 \times 97{\cdot}17 + 2{,}250 \times 0{\cdot}78]$$
$$= \frac{1}{100}[846{,}350 \qquad + 1{,}755]$$
$$= 8{,}481 \text{ calories,}$$

which is 478 calories higher than the experimental result.

A similar formula is that of E. Lenoble, where

$$Q = 87{\cdot}4\ (100 - K),$$

K being the sum of the percentage of ash and moisture, the moisture being determined by heating the coal for two hours at 105 degs. Cent. The calorific value of the same coal, calculated from this formula, is 8,561 calories, or 558 calories higher than the experimental result.

The last formula which will be mentioned is that of Goutal.

$$Q = 82\,C + \alpha\,V$$

Where

C = percentage of fixed carbon,

V = percentage of volatile matter,

and α is a variable factor depending on the ratio $\dfrac{100\,V}{C + V}$.

This assumes that the fixed carbon has always the same heat of combustion of 8,200 calories per gramme, which is probably not far from the truth, while the fact that the heat of combustion of the volatile matter will vary with its composition is allowed for by the factor α. Hence this formula has probably a more general application than the two preceding ones. The values of α corresponding with the values of the ratio $\dfrac{100\,V}{C + V}$ are given in the following table:—

FACTORS FOR GOUTAL'S FORMULA.

$\dfrac{V \times 100}{C + V}$	α	$\dfrac{V \times 100}{C + V}$	α	$\dfrac{V \times 100}{C + V}$	α
1 to 4 ...	100	16 ...	115	28 ...	100
5 ...	145	17 ...	113	29 ...	99
6 ...	142	18 ...	112	30 ...	98
7 ...	139	19 ...	110	31 ...	97
8 ...	136	20 ...	109	32 ...	97
9 ...	133	21 ...	108	33 ...	96
10 ...	130	22 ...	107	34 ...	95
11 ...	127	23 ...	105	35 ...	94
12 ...	124	24 ...	104	36 ...	91
13 ...	122	25 ...	103	37 ...	88
14 ...	120	26 ...	102	38 ...	85
15 ...	117	27 ...	101	39 ...	82
				40 ...	80

If we calculate the calorific value of the same coal as in the preceding examples, it is necessary first to find the value of α.

In order to do this first find the value of

$$\frac{100\,V}{C + V}.$$

For this coal this will be

$$\frac{3{,}770}{60{\cdot}25 + 37{\cdot}70} = 38{\cdot}45.$$

By reference to the table it will be found that the corresponding value of α is 83·5. Hence we have

$$Q = 82 \times 60{\cdot}25 + 83{\cdot}5 \times 37{\cdot}70 = 4{,}940 + 3{,}148 = 8{,}088 \text{ calories},$$

which is 85 calories more than the experimental value.

It will be noticed that of the calculated values, those obtained from the ultimate analysis and by Goutal's formula from the proximate analysis, are in best agreement with that found by the calorimeter. The coal analysis which has been used in these calculations was taken at random; but it is reasonable to believe that when calculation has to be resorted to, Dulong's formula is likely to give the more reliable results if the ultimate analysis is available, and Goutal's if the proximate analysis has to be used.

The pyrometric heating effect, or the temperature attained by the combustion of fuel, is of importance in metallurgical operations. The theoretical value can be calculated if it is assumed that all the heat produced by combustion is absorbed by the products of combustion, and that they have constant specific heats.

Since, however, these assumptions are not true, and the theoretical values for calorific intensity thus calculated have very little practical importance, the temperatures realised in practice falling far short of them, it is not necessary to give the formula here.

THE STORAGE OF COAL.

The storage of coal in presence of air is often attended by a considerable deterioration of quality, and sometimes by heating, which under certain conditions may give rise to actual ignition of the coal. Both deterioration and spontaneous ignition appear to be due primarily to the same causes, the oxidation of the coal and its impurities. In the seam the pores of the coal are filled with methane, or with a mixture of methane and carbon dioxide. After mining and exposure to the air these gases are given off, oxygen is absorbed in their place and oxidation of the hydrocarbons of the coal substance takes place, resulting in the slow production of carbon dioxide and water, while a certain amount of the oxygen enters directly into the composition of the coal. These changes are accompanied by an evolution of heat, and a loss in the calorific value of the coal. They may also be accompanied by a change in the properties of the coal, such as loss of coking power. As in all cases of oxidation the rate at which this takes place depends upon various factors, such as the initial temperature, the extent of the exposed surface in relation to the mass of the coal and the supply of oxygen. As a rule, so long as the coal is in large lumps there is no appreciable heating because the oxidation is so slow that the heat developed is removed at a sufficient rate. When the coal is more finely

divided, as in the case of a mixture of small coal and dust, oxidation will proceed at a greater rate, and heating may occur. The rise in temperature will itself tend to increase the rate of oxidation, and eventually the ignition temperature may be reached and a fire occur. Coals vary in their tendency to "weather," depending upon the ease with which they undergo oxidation under atmospheric influences. Reasons for this have been sought in variations in the amount of pyrites and moisture, and differences of porosity. It was formerly supposed that pyrites, on account of the ease with which it oxidises, was the primary cause of the spontaneous ignition of coal. This view is no longer generally accepted, since the tendency of coals to ignite spontaneously seems to bear no relation to the amount of pyrites which they contain. It is stated, however, that while pyrites does not fire when pure, it may do so when mixed with organic matter as in coal. It is probable in any case that pyrites and moisture may be contributory causes, since by the oxidation of pyrites in a moist atmosphere, the coal becomes disintegrated, and thus more exposed to the action of atmospheric oxygen.

Richters' experiments have shown that the increase in weight of a coal when heated at 190 degs. Cent. is due to the absorption of oxygen, and that the loss of carbon and hydrogen which results is due to slow oxidation to carbon dioxide and water, and not to the loss of hydrocarbons. The absorption of oxygen appeared to be due to chemical action, the oxygen becoming combined with the coal substance, and not to physical absorption. Richters further showed experimentally the absorption of oxygen from the air by coal, at the ordinary temperature, and showed that the absorption is most vigorous when the coal is fresh. He considered that the earlier vigorous stages might be in part physical, preceding the chemical combination, and further that there was a relation between the amount of oxygen absorbed and the original amount of disposable hydrogen in the coal, since with the disappearance of disposable hydrogen the oxygen absorption ceases.

Fayol's experiments on the coals of Commentry have shown that under the action of the air, all coals behaved in a similar manner as regards change of weight. The weight first decreases, then increases, sometimes considerably beyond the initial weight, and finally the weight diminishes again and continues to do so. The state of division of the coal has much influence upon these changes, which occur the more slowly the larger the coal fragments. The periods of change are shorter and more marked as the temperature becomes higher. He considered that these changes may be explained as the resultant of various factors. Thus coal is capable of absorbing a considerable amount of oxygen and within limits, the higher the temperature the more oxygen is absorbed. This will tend to cause the weight to increase. On the other hand, rise of temperature favours loss of weight due to loss of hygroscopic water, decomposition of the coal and slow combustion.

Fayol also showed that coal which had been stored under water for over two years at the ordinary temperature underwent no appreciable change either in appearance or properties.

Fisher, by the action of bromine on coals, showed the presence of unsaturated compounds. He also showed that powdered coal in moist air gave CO_2 and H_2O, and that the coal increased in weight, and afterwards absorbed less bromine than before, showing that change in composition had occurred. He concludes that coal contains varying proportions of unsaturated bodies which absorb oxygen, thus gaining in weight, and also other compounds which oxidise, giving off CO_2 and H_2O. Thus, a coal in storage may gain, lose, or remain constant in weight, according to relative proportions of the two classes of compounds, but will almost invariably deteriorate in value. Coals are best stored in a cool place. He further considers that moisture assists in oxidation, that the effect of pyrites is over-estimated, and that the value of ventilation is doubtful because, although it will help to keep coal cool, it will also supply the oxygen necessary for combustion.

Recent experiments by Parr and Hamilton, in the United States, have been carried out on 100 lb. samples, in nut size, which were submitted to (*a*) outdoor exposure, (*b*) exposure to dry atmosphere at 85 degs. to 120 degs. Fahr., (*c*) to same temperature, the coal being wetted two or three times a week, (*d*) submergence under water at about 70 degs. Fahr. The tests lasted over nine months, and the results confirm the conclusions of previous workers. They are :—

1. Submerged coal does not lose appreciably in heat value.
2. Outdoor exposure results in a loss of heating value of from 2 to 10 per cent.
3. Dry storage has no advantage over storage in the open, except with high sulphur coals, when the disintegrating effect of sulphur during oxidation facilitates the escape of hydrocarbons or their oxidation.
4. In most cases losses in storage appear to be practically complete at the end of five months. From the seventh to the ninth month the losses are inappreciable.

Although these tests were carried out only on small samples, yet it seems reasonable to conclude that the quantitative results may not be without value in considering the behaviour of coal in large storage heaps.

An important feature of the weathering process is the rapidity with which it proceeds as soon as the coal leaves the seam.

Spontaneous ignition of coal is due to the same causes as weathering. The conditions favourable to the spontaneous ignition of coal are a sufficient, but not an excessive supply of air, a suitable degree of subdivision of the coal, and a non-conducting environment, so that much of the heat produced by the slow oxidation of the coal is available for raising the temperature of the coal itself. If the air supply be sufficiently great to carry away the heat generated at a sufficient rate, no heating will occur, and if the coal be protected from contact with air, naturally oxidation cannot take place. If the coal is in large pieces, oxygen will only be absorbed slowly on account of the small surface exposed in relation to the mass of coal, while if the coal is in the state of very fine dust, then air will not be able to penetrate the heap freely. There is, therefore, a certain size of coal when the exposure of surface and accessibility to air are such that the absorption of

oxygen will be at a maximum, and Fayol observed that heaps of small coal mixed with dust offered the most favourable conditions for heating, and that it is only in large masses that heating and spontaneous ignition were liable to occur. Fayol's experiments on the coal of Commentry lead to the conclusions that in shallow layers coal does not heat, that the rise of temperature increases with the height of the heap, that at a height of 3 to 4 metres the temperature rises to 60 degs. or 70 degs. Cent., but falls away without exceeding this temperature. Heaps over 4 metres in height showed a continual rise of temperature, and after about three months, steam and smoke appeared. The highest temperature was immediately beneath the highest part of the heap and near the ground. It was further shown that washed slack heaped in a wet state was less weathered and less heated than unwashed slack. Hence, it would appear that moisture does not favour spontaneous ignition, though it may do so indirectly by facilitating disintegration. With regard to the susceptibility to spontaneous ignition of different classes of coal, it appears that this is in the same order as their inflammability :

1. Lignite.
2. Gas coal.
3. Coking coal.
4. Anthracite.

The means which may be adopted to prevent spontaneous combustion are storage of coal in large pieces, preserving a low temperature, stacking small quantities, and ensuring either very effective ventilation or else complete absence of air. With regard to ventilation, this must be excessive to be effective, and it has been shown by experience that if any accident interrupts the ventilating arrangements, a heap is likely to ignite much more quickly than if it had not been ventilated at all. Fayol suggests that immersion of the coal in water, or covering the heap with clay or wetted coaldust, would give excellent results.

Thus, if weathering be prevented, there will be no danger of spontaneous combustion, and the best means of preserving coal in good condition is by keeping it from the action of the air, either by storage under water or by covering it with some material through which air cannot readily pass.

It may be mentioned that it has recently been suggested that the heating and spontaneous ignition of coal may be due to bacterial action.

With regard to the varying behaviour of coals generally, as well as in respect of their liability to change under atmospheric influences, it is not unreasonable to suppose that the cause of these differences may ultimately be found in the constitution of the coal substance. Coal is a very complex body, and one may suppose that there are much greater differences in the constitution of different coals than are shown by their elementary analyses, and it is not unlikely that some coals contain a greater proportion of definite compounds of an easily oxidisable nature than others. Moreover, the possibility of isomerism must also be admitted. There are many parallel cases in the domain of organic chemistty. We have here

examples not only of compounds of the same percentage composition, but different constitution and molecular weight, which are totally different in properties, but of compounds of the same percentage composition and the same molecular weight, differing very greatly. It is probable that it will be by investigation along this path that we shall in the future make most progress in our knowledge of the properties of coal. As yet but little success has been achieved, however, and it is not possible to draw any conclusions. Percy treated lignite, bituminous coal and anthracite with nitric acid, sulphuric acid, sodium hypochlorite and potash. He found that lignite was most acted upon, bituminous coal less so, while anthracite was very little affected. It is interesting to note that the relation between these classes of coal is the same as that which has been established between their inflammability and liability to spontaneous combustion. Carrick Anderson and Roberts have treated coal with nitric acid, and by subsequent treatment with ammonia, have obtained black substances, the so-called "coal acids." These contain carbon, hydrogen, oxygen, nitrogen, sulphur and a little iron. They do not appear to have isolated any definite compounds, however. Phillips Bedson discovered that pyridine had a remarkable action upon coal, and investigations are in progress.

Other workers, by extracting coal with organic solvents, such as ether, alcohol, benzene, petroleum-ether, chloroform, acetone, and subsequent treatment of the residue, have obtained complex bodies, and difficult though the task may be, it is certain that eventually valuable results may be obtained, which will throw light on the nature of coal, and assist us to understand the causes of its variable behaviour.

In a recent Memoir of the Geological Survey, by Drs. Strahan and Pollard, on the coals of South Wales, evidence is adduced favouring the view that the differences between anthracite and bituminous coals is due to differences in the vegetable matter from which the coals were originally derived. Apart from geological evidence, this conclusion is based mainly upon the different proportions of ash in bituminous coals and anthracite, and this is a case when a fuller knowledge of the proximate constituents of coal might materially assist the elucidation of the problem.

It has not been possible to refer in the text of this article to the sources of information which have been consulted during its compilation. The writer wishes, however, to make full acknowledgment to the following authorities and literature, of which free use has been made:—W. Carrick Anderson, "Chemistry of Coke" (second edition); E. Prost, "Chemical Analysis"; T. E. Thorpe, "Dictionary of Applied Chemistry"; Geo. E. Davis, "Chemical Engineering"; Drs. Strahan and Pollard, "South Wales Coalfield and Origin of Anthracite" (Memoir of H.M. Geological Survey); Report of Royal Commission on Arsenical Poisoning; Report of Royal Commission in New South Wales on the Spontaneous Ignition of Coal; *Bulletins* of the Geological Survey of the United States of America; the *Colliery Guardian*; the *Engineer*; *Engineering*; and other journals.

The "Colliery Guardian" Coalfields Map, giving the lines of Equal Magnetic Declination for January 1, 1912.
Also the Mines Inspection Districts and principal shipping ports.

TABLE OF LOCAL CORRECTIONS TO BE APPLIED TO THE MAGNETIC DECLINATION.

Town	Corrections in Minutes of Arc.
Edinburgh	+ 4
Kirkcaldy	+ 2
Falkirk	+16
Hamilton	— 1
Glasgow	—11
New-Cumnock	— 9
Ayr	— 9
Whitehaven	+ 7
Maryport	0
Wigton	+ 2
Berwick-on-Tweed	—21
Morpeth	— 5
Newcastle	— 4
Sunderland	—10
Durham	— 9
Bishop Auckland	— 4
Stockton	— 1
Guisborough	— 2
Leeds	— 7
Pontefract	+ 6
Huddersfield	— 4
Barnsley	+ 4
Sheffield	+23
Chesterfield	+11
Mansfield	+ 6
Nottingham	— 4
Burnley	—11
Rochdale	—24
Bolton	—11
Wigan	— 7
St. Helen's	— 3
Manchester	—17
Congleton	—13
Stoke-on-Trent	0
Flint	+ 4
Mold	+ 3
Wrexham	+ 4
Shrewsbury	+ 8
Wellington	+ 8
Rugeley	— 6
Wolverhampton	—20
Walsall	—21
Dudley	—20
Birmingham	—23
Tamworth	+10
Atherstone	+40
Nuneaton	+14
Ashby-de-la-Zouch	—12
Lydney	— 5
Bristol	— 3
Radstock	0
Pontypool	+ 3
Cardiff	— 5
Pontypridd	— 6
Neath	+ 4
Aberdare	+ 4
Swansea	— 8
Llanelly	—10
Haverfordwest	—19
Dover	—10
London (Kew)	+16

In the above map the EXPOSED COALFIELDS are shewn by blue washes, and the HIDDEN COALFIELDS by blue shade lines; the boundaries of the MINES INSPECTION DISTRICTS are indicated by strong black lines, and RAILWAYS are shewn in red. The chief COAL EXPORTING TOWNS are printed in red, and those TOWNS POSSESSING A MINING UNIVERSITY OR COLLEGE approved under the Coal Mines Regulation Act 1887 Amendment Act, 1903, are in black capitals.

The Isogonals or LINES OF EQUAL MAGNETIC DECLINATION are laid down for January 1, 1912. The lines are mean lines, and considerable local deviations are found to exist, particularly in the Birmingham district. For any case in which greater accuracy is required reference should be made to the TABLE OF LOCAL VARIATIONS IN DECLINATION inserted as an inset, which gives the amounts of deviation from the mean values indicated by the isogonals at a number of places fairly evenly spread over the mining districts. *Corrections shown + are to be added to the Declination as determined from the map and those shown — are to be subtracted.* Corrections for places not mentioned in the table may be obtained by taking proportional distances from the two nearest towns given. The Magnetic Declination was *diminishing* at the annual rate of about 7·5 minutes during 1909—1910, but this diminution was not quite uniform for all parts or the Kingdom.

CHARACTERISTICS of the CHIEF COAL SEAMS worked in the BRITISH ISLES.

CHARACTERISTICS of the CHIEF COAL SEAMS WORKED in the BRITISH ISLES.

ALTHOUGH plentiful information is available with regard to the structure of the coalfields of this country and the number and thickness of the seams, as well as their depth below the surface, it is often very difficult to obtain any details of their quality and commercial value. For some reason, not easy to understand, this point of view is almost totally ignored in coalfield literature, notwithstanding the fact that it is one of the first things which the users of coal require to know.

An endeavour has been made in the following pages to summarise, as briefly as possible, the available and extremely scattered information upon the characters of our principal coalseams. The result is admittedly imperfect; but it is hoped that it will at least serve the purpose of stimulating those conversant with the local characters of our coals to send us fuller information to incorporate in subsequent editions. The arrangement of the subject follows the inspection districts, with one exception. The following order has been observed :—

1. The Scotch coalfields.
2. The coalfields of England and North Wales.
3. The South Wales coalfield.
4. The Irish coalfields.

THE SCOTCH COALFIELDS.

DUMFRIESSHIRE.

In the Canonbie coalfield there are several workable seams of bituminous coals. The chief are the FOUR-FEET and BLACK TOP seams.

Sanquhar coalfield has the CALMSTONE coal of good household quality, resembling the Ell coal of Lanarkshire, also Splint coal not unlike that of Lanarkshire both in quality and appearance. Seams of cannel are believed to exist in the northern part of the coalfield, but have not been exploited.

ARGYLL.

At Campbeltown the MAIN seam is used for manufacturing purposes.

AYRSHIRE.

Muirkirk district has coals very suitable for smelting iron ores. The most profitable seams are the THREE-FOOT coal at Glenbuck, and the NINE-FOOT coal at Glenbuck and Muirkirk, which contain bands of rich cannel. The SIX-FOOT or CATCHYBURN seam has occasional gas coal at Glenbuck, where a seam of very rich Boghead gas coal, 7 in. thick, has been worked. At Gass Water, Guelt and New Cumnock the coal is very hard and splinty. In the neighbourhood of Dalry the WEE coalseam is sometimes a gas coal. The LADY BOSWELL seam is worked at Coylton, for household, manufacturing and steam coal.

The Girvan coalfield has generally coarse coals with rather high ash, useful for local purposes. The MAIN and ELL coalseams are the best in quality.

New Cumnock district is noted for its cannel, associated with a lustrous black coal, with a brown streak, forming good gas coal, and also a soft, black coal of very high quality for household purposes. The THREE-FOOT coal makes an excellent coke. The FOUR-FOOT and EIGHT-FOOT seams require careful screening.

In the Dalmellington coalfield the lower coals have coking properties not found in the upper seams. The CHALMERSTON seam is a manufacturing coal. The HIGH SPLINT and SLOANSTONE seams are also worked.

The MAIN coal in the Cumnock and Lugar districts is a first-class house coal, known in the market as the "BUTE JEWEL" or the "BOSWELL JEWEL." The MAIN SPLINT coal of the same area is a good furnace coal.

The Ayr coalfield has both soft and splint coal (AYR HARD); the latter being the most valuable seam. In the Kilmarnock and Galston district the TOURHALL coal is a good house coal. The McNAUGHT seam is of fairly good quality, and the TOURHALL coal is a good house coal. The MAJOR coal is a somewhat variable house coal. Other seams are hard and splinty, and suitable for furnace coal. The MAIN coal is the best house coal in this district.

In the Saltcoats and Kilwinning coalfields is found the BLIND coal of Caprington, an anthracitic coal produced by contact with whinstone. This has long been in use for smelting, but is now nearly exhausted.

RENFREWSHIRE.

The HURLET coal lies deep, and is still almost intact.

LANARKSHIRE.

The UPPER coalseam at Govan and Stonelaw is an excellent house coal.

The ELL coal is of exceptional quality, much in demand for household use; but in the Airdrie district this seam becomes hard and splinty, and more suitable for furnace and manufacturing use.

The PYOTSHAW coal between Cambuslang and Hamilton is hard and splinty, and suitable for furnace and manufacturing purposes. The MAIN coal, often only

separated by a thin parting from the Pyotshaw seam, is a bright, black coal used as a second-class house coal, and for manufacturing and locomotive purposes. It has ribs of splint coal, and sometimes one of cannel of fair quality. It is liable to contain "pugs" of bastard gas coal, which are sometimes picked out and sold separately for gas making purposes. These yield good gas, but the coke is soft and of little value. Sometimes the Splint coal is separated by hand picking and sold as steam coal.

The HUMPH coal is a useful smithy coal.

The SPLINT coal is suitable for iron smelting and gas making. There is usually a layer of cannel associated with it. The VIRGIN coal often affords a house coal of good quality. The MUSSEL-BAND coal is largely used for gas making. The seams above the Virgin coal form the Upper seams.

The Lower seams of Lanarkshire include the VIRTUEWELL coal, a bright black coal coarser than the Ell seam, but making good house coal; it corresponds with the Johnstone coal of Slamannan.

The KILTONGUE coal is often hard and splinty, and of second-class quality, but in the Coatbridge district is largely used for gasmaking purposes; it makes good coke and sometimes has at the top a band of cannel, one of the richest in the country.

The UPPER DRUMGRAY coal is a hard, blue-black coal suitable for furnaces in the Clyde basin, but in the Slamannan district it is a first-class steam coal, known as COXROAD coal. The LOWER DRUMGRAY coal is generally softer, and of better quality for household purposes. Beneath the Drumgray coals of the Clyde basin are several seams of moderate quality, amongst which the MILL coal, BALL coal and MAIN coal are worked in the Shotts and Benhar district. Owing to the influence of whinstone dykes, in several places these coals have become good steam coal and even anthracite; but in other parts the coals have been so burnt as to be useless. The POSSIL MAIN coal of Bishopsriggs is of fairly good household quality. The BLACKBAND seam of Motherwell is used as a house and steam coal.

In the Douglas and Lesmahagow coalfield, the best seams are the SEVEN-FOOT and NINE-FOOT seams, now almost exhausted. The quality resembles the best Lanarkshire Ell coals. In the Coalburn district, although the coals are generally somewhat inferior, their commercial value is largely increased by bands of gas coal. The common qualities are used for locomotive purposes, and some are sold for general steam-raising and bunker purposes. The NINE-FOOT and SEVEN-FOOT seams are chiefly sold as gas coals, and contain bands of cannel of high quality. These are not generally separated, the whole seam being dealt with collectively. The famous Lesmahagow gas coals were thin seams of cannel mined near Auchenheath. The BIG DRUM coal in the Ponfeigh district is of similar character to that of Coalburn. It is largely used for locomotive and manufacturing purposes. Nearly every seam contains bands of good cannel. A gas-coal seam has been extensively worked at Haywood, Wilsontown, and Climpy Collieries, the quality being not far below the

Main Lesmahagow cannel. In the Carluke district the Lesmahagow gas coal is thin, but has been worked to some extent. The CARLUKE SMITHY seam is used for household, steam or manufacturing purposes.

DUMBARTONSHIRE.

In the Kirkintilloch and Kilsyth districts the seams are very variable in thickness, much faulted and often greatly burnt by whinstone intrusions. Yet the seams are often of considerable value, coking well to a coke of very high quality. At Kilsyth the HOUSE COAL is a very good household coal, with fine coking qualities. Other seams afford good smithy and coking coals. The HURLET coal in the Campsie district contains much pyrites, which is separated and sold to chemical manufacturers.

STIRLINGSHIRE.

The Slamannan coalfield produces a steam coal of very high quality, and at Eastfield, in the Longriggend district, the COXROAD seam has been burnt by whin dykes to a hard anthracite. The SPLINT coal of Lochend is of similar character, and is worked as an anthracite, practically smokeless, and with nearly 80 per cent. of carbon. The LADY GRANGE seam is used for both house and steam purposes. In the Bannockburn district the GREENYARD coalseam, known commercially as the Bannockburn Hartley steam coal, is a first-class coal for steam-raising, as well as for household purposes. The MAIN coalseam (known in commerce as the Bannockburn Wallsend drawing room coal) is an exceptionally good house coal. This coal also makes a good foundry coke.

The seams at Denny have been slightly burnt to a smithy coal of high quality. The UPPER DRUMGRAY seam is also worked in West Stirlingshire.

LINLITHGOWSHIRE.

The Bo'ness coalfield has the SPLINT coal, CORBIEHALL coal, SEVEN-FOOT coal, a fairly good steam coal, the WESTERMAIN coalseam, now almost worked out, the RED coal of fair quality, and the CRAW coal, a fairly good house and steam coal; in some places the best part of the seam is cannel. The SIX-FOOT coal is of good quality, but often split up by dirt bands. The EASTER MAIN coal, now almost worked out, is of very high quality with no dirt bands or pyrites. The SMITHY coal is better than its name implies, and is really a good coking coal. All the Bo'ness seams deteriorate, both in quality and thickness, as they approach the volcanic area southwards at Linlithgow.

At Balbardie, near Bathgate, is the BALBARDIE gas coal seam, a cannel of high value, but thin. The LADY MORTON coal seam and the WOODMUIR MAIN coalseam are of fairly good quality for house and steam purposes.

In the carboniferous limestone series, the PARROT coal seam and the MAIN coal seam have been worked, but are much mixed with dirt bands,

The Armadale district has several second-class seams, which have been much worked on account of the presence here of the famous Torbanehill cannel coal. The MILL coal is the best and makes a second-class house coal, and a fair steam coal. The BALL coal is used locally in the oilworks. The COLINBURN coal is of somewhat similar character to the Mill seam.

MID AND EAST LOTHIAN COALFIELDS.

The GREAT seam coal is generally sold as a steam coal. The DIAMOND coal is a very good house coal, while the SPLINT coal is a first-class steam coal. The JEWEL coal is a fairly good house and steam coal. The seams become impoverished towards the south.

In the Niddrie district the SOUTH PARROT seam consists of splint coal (18 in.) and cannel (12 in.) The GREAT seam at Niddrie is valued largely on account of the Parrot (cannel) coal in the upper part of the seam. The STAIRHEAD cannel and the EDMONDSTONE cannel are also worked in this area. The CARLTON coal is an excellent house coal, as also is the NORTH GREENS coal, which contains a thin seam of cannel.

In the eastern side of the coalfield the best seam is the CARBERRY JEWEL coal, an excellent household coal. The GARIBALDI seam is a good steam coal.

The PEACOCK, CORBIE SPLINT and NORTH coals of the Loanhead district are good household coals. The GREAT seam here has no cannel, and is an excellent steam coal.

The ARNISTON DUNDAS coal is a very good house coal, clean, and with very little sulphur or ash. The Splint seam in this area is also an excellent house coal. The ARNISTON PARROT or JEWEL seam is a superior house coal in its upper part, high quality cannel in the centre, and second-class house coal below. The cannel is superior to that of Lesmahagow.

HADDINGTONSHIRE.

In the Haddingtonshire coalfield the chief seams are the GREAT seam, a fairly good house and steam coal, containing no cannel; SPLINT coal, good house coal; PARROT seam, containing steam coal, cannel and house coal; THREE-FOOT seam; FOUR-FOOT seam; FIVE-FOOT seam; PENSTONE TRYSING or PANWOOD seam, all yielding good steam or second-class house coals.

CLACKMANNAN.

In the Alloa coalfield the chief workings are in the UPPER FIVE-FOOT seam, nearly exhausted. The NINE-FOOT seam, consisting of Splint coal, with a seam of Parrot coal at the top, is largely worked out. CHERRY or LOWER FIVE-FOOT seam is an excellent house coal at bottom, steam coal at top, and is known commercially as ALLOA JEWEL coal. The SPLINT coal is a good quality steam coal. The MOSIE seam is occasionally worked, but is usually too thin and inferior in quality.

FIFESHIRE.

The Dunfermline coalfield contains the following seams in the carboniferous limestone formation :—

BRIGHT coal seam, splinty coal, not much worked; SIX-FOOT coalseam, steam or manufacturing coal; CAIRNCUBIE seam, second-class quality; SWALLOWDRUM, very moderate quality; UPPER EIGHT-FOOT seam, not high-class quality, but used largely for manufacturing purposes. LOWER EIGHT-FOOT seam is better in quality and makes a fairly good steam coal; FIVE-FOOT coal, a good, bright, black steam coal, but only second-class house coal; DUNFERMLINE SPLINT coal, always good quality, either as house coal on the east or first-class steam coal on the western side of the basin. Locally it is converted into "blind coal" or coarse anthracite by proximity or whinstone.

In the Blairadam and Kelty coalfield the SPLINT coal is better than at Dunfermline, and furnishes an ideal coal for household or steam-raising purposes. It forms the AITKEN WALLSEND house coal of commerce. The FIVE-FOOT seam known as AITKEN HARTLEY coal, when mined with the Wallsend variety in equal proportions, is known commercially as the AITKEN NAVIGATION coal. In this district the SWALLOWDRUM coal of Dunfermline is represented by the BANK coal or LOCHGELLY SPLINT, which here becomes a fairly good house and steam coal. The CAIRNCUBIE seam also appears at Lassodie as a first-class house coal. The JERSEY coal, possibly representing the BRIGHT coal, is a soft house coal at Lassodie. The MAIN coal of Kelty is worked for steam and bunker purposes.

WEST FIFE.

Near Oakley, the BLAIRHALL main coal is a good clean coal used largely for gas making. At Kinedder the SPLINT coal is fairly good household coal, and the FIVE-FEET seam is a steam coal. The TOP coal at the Steelend pits is very good steam coal, and is also used for smithy purposes. The Lower seam contains Parrot coal (cannel) and is suitable for gas making.

THE LOCHGELLY COALFIELD.

Lower seams as in the Dunfermline district. The upper seams contain the LITTLE SPLINT, FOURTEEN-FOOT and DUDDY DAVIE, used mostly for second-class steam coals. The Lochore Parrot coals somewhat resemble the Boghead cannel, giving rather less yield of gas, but producing coke of a quality suitable for firing gas retorts and similar purposes.

KIRKCALDY COALFIELD.

The LOCHGELLY SPLINT coal is the best seam and is used as a first quality household and steam coal. The PARROT coal at Dundonald is a SPLINT coal, but farther east becomes a second-class gas coal. The GLASSIE and MYNHEER coals have been burnt by intrusive whins and converted into steam and smithy coals of fair quality. The Dunfermline Five-foot and Splint seams thin out here and are not workable.

EAST FIFESHIRE.

The Lochty coalfield is scarcely worked.

The Largo, Largoward and Raderine coalfield contains the LARGOWARD Splint coal, which is of good quality.

The coal-measure coals are worked in the Leven and Dysart coalfield and in the Kinglassie coalfield. In the former the seams chiefly worked are the BARNCRAIG coal, chiefly used as a steam coal, but sometimes as a household coal; COXTOOL coal is a steam coal; CHEMISS seam has an upper part of good house coal and a lower part of steam coal; EARL'S PARROT seam is a fairly good gas coal, and yields cannel at Leven; DYSART MAIN coal has been very largely worked. As it approaches the east beneath the sea, it becomes more anthracitic, and is much used by brewers. The BOWHOUSE seam is a gas coal.

In the Kinglassie coalfield similar seams occur, but only the DYSART MAIN has yet been worked and only to a small extent.

THE COALFIELDS OF ENGLAND AND NORTH WALES.

NORTHUMBERLAND AND DURHAM COALFIELD.

The following are the chief seams occurring in this coalfield in descending order:—

The HIGH MAIN seam of the Tyne collieries is of a rich and caking quality, burning rather quickly, making a hot fire and leaving but little ash. At Seaton Delaval and Hartley, however, it loses richness, burns openly leaving a white ash and makes a pretty good steam coal. This seam furnishes the original Wallsend coal, and was at its best between the Tyne and the Ninety-Fathom Dyke. It is now almost exhausted.

The FIVE-QUARTER seam of the Wear and Tees districts together form the GREY seam, which furnishes the coal known as Tees Wallsend. Near Newcastle this makes two seams, the METAL coal and STOVE coal. The coal from the Grey seam is rich and caking, rather harder than the HIGH MAIN, but leaving more ash. In places it becomes less bituminous, and associated with splint coal it then makes a good steam coal, as near Durham.

The YARD coal of the Hartley district is an excellent steam coal. South of the Tyne it produces coals varying from first to second household quality, harder than the High Main seam of the Tyne. In the eastern parts of Durham it forms the WEAR MAIN coal, a strong coal, but somewhat inferior in quality.

The BENSHAM seam of the Tyne, known as the MAUDLIN seam in the Wear district, produces coals of rather tender description, interstratified with splint, and inferior in quality as house coal, but has been much used for gas manufacture; its quality improves towards the east. Towards the south, at Hetton it becomes a strong steam coal, and nearer Durham improves greatly in quality. At Tanfield,

although tender, its freedom from sulphur causes it to be in demand for metallurgical use.

The LOW MAIN seam of the Tyne, known as the HUTTON seam of the Wear, is also variable in quality. At Hartley and West Cramlington it is a first-class steam coal, working large, burning quickly, leaving a white ash, but no clinker. In places, as at Felling, it is more tender, being much in request as a gas coal. The small coal is much used as a smithy coal, and is free from pyrites. At Haswell, the bottom part is worked as a steam coal, the upper part being a first-rate household coal. This seam is the most valuable in the district, yielding the Cramlington and Hartley steam coals north of the Tyne; the Felling, Peareth and Pelton gas coals between the Tyne and Wear; and the Lambton's, Stewarts, Hetton and Haswell Wallsend house coals beneath the magnesian limestone area. It is not so hard, and does not bear carriage so well as the Five-Quarter seam, but is superior in quality.

The PLESSY seam makes an excellent steam coal in the Blyth Valley.

The BEAUMONT seam of the Tyne is called also HARVEY'S LOW MAIN, the TOWNELEY, ENGINE and BARLOWFIELD seam, and in the Auckland and Etherley district the YARD coalseam. At Towneley it is a good gas coal, having a seam of cannel at the top. In the Tyne area it produces a uniformly good second-class household coal. It is a good gas coal, and makes good coke.

The LOWER FIVE-QUARTER seam at Towneley produces rather tender coals, not very good for export, but making good manufacturing and smithy coal. It makes excellent coke.

The THREE-QUARTER seam has not proved largely workable.

The BUSTY seam in the Brancepeth district furnishes good blast-furnace coke.

The BROCKWELL seam is generally rather tender, but of good quality and cokes well. As a household coal it is generally second rate. Its important properties are its cheapness of working and the superiority of its coke.

Of the coals in the Northumberland and Durham coalfield generally, Mr. G. C. Greenwell says that the variation in quality in different areas often affects all the seams. Thus, in the Cramlington district all the seams are very hard, free, and open burning, with a white ash, and suitable for steam purposes. In the Heworth district the same coals are friable and tender, adapted for gas manufacture, but not so suitable for steam purposes; in the Tanfield and Crook districts there is still less hardness but greater purity, and consequently better adaptation for manufacturing and coking purposes. In the Hetton and Blackboy districts the same seams afford coal of the finest household quality, and almost as hard as in the Cramlington area.

A thin band of cannel coal was formerly worked in some districts, as at Wallsend Pelton Main and Washing Colliery, and Ramsey's Colliery, Newcastle-on-Tyne.

The Bernician Coals of Northumberland, as worked in the Berwick and Haltwhistle districts, include the FELLTOP LIMESTONE coal, OAKWOOD coal, LITTLE LIMESTONE coal, known as ACOMB seam, BLENKINSOPP coal, HALTWHISTLE coal,

CLAREWOOD, INGHOE, CAMBO, COOPER EYE, BOGHALL, and ROTHLEY seams. These are chiefly used as household coals.

SHILBOTTLE seam, said to be the best in the series, is very hard and durable, and leaves a heavy dark-brown ash.

COWDEN coal is worked as a household coal at Simondburn.

REDESDALE coals comprise STIDDLE HILL coal, UPPER HALL seam, BELLINGHAM coals, ELSDON seam, &c.

PLASHETTS coals are of excellent quality for landsale purposes, comprising the BLACKHILL seam, SCREMERSTON MAIN or the CRAW coal, and the HARDY or KILN coal. These coals are often very hard and lumpy.

CUMBERLAND COALFIELD.

One of the principal seams worked in this district is the BANNOCKBAND, at Whitehaven and Workington, supposed to be represented by the TEN-QUARTER seam of Maryport. Below this is the MAIN BAND of Whitehaven and Workington, which consists, over part of the district, of two beds, the METAL BAND and CANNEL BAND. Lower still is the LOW BOTTOM seam of Whitehaven, forming the SIX-QUARTER seam of other districts. Mr. T. P. Martin gave the following account of the seams of this coalfield in his evidence before the Royal Commission. The seams are in descending order, but are not all present in each of the three districts of Whitehaven, Workington and Maryport:—

SENHOUSE seam, house, steam and coking coal; HAMILTON seam, steam coal; VIRGIN seam, house, steam and coking coal; WHITE METAL seam, steam coal; TEN-QUARTER seam, house, steam and coking coal over a small part of the district, the bottom coal is of inferior quality; RATTLER seam, house, steam and coking coal; CROW seam, steam coal, usually of inferior quality and unworkable over a great part of the district. To the extreme east it is the only member of the MAIN BAND group existing, and has been worked to a considerable extent; MAIN, METAL BAND and CANNEL BAND, house, steam and coking coal. Over part of the field the seam is divided into two beds. To the east the strata between the two beds increase in thickness; the seam itself is also much split up with beds of shale, and is unworkable. YARD seam, house coal and coking coal. Over the central portion of the field this seam is thin and of inferior quality. To the north-east it increases in thickness, and the Upper or Main coal improves very much in quality. The section in that district is as follows:—Coal 3 ft. 9 in., shale 2 in., coal 7 in., total 4 ft. 6 in. Over part of this area the bottom is of inferior quality. LITTLE MAIN seam, house, gas and coking coal; SIX-QUARTER, house, steam, coking and, over a small part of the field, gas coal. The thickness of the coal varies very much, and also the number and thickness of the bands of shale it contains; THREE-QUARTER seam, house, steam and coking coal; FOUR-FOOT seam, steam coal; UDALE seam, inferior steam coal. Other seams worked are the THIRTY-INCH and LICKBANK.

The LITTLE LIMESTONE coal is worked at Alston as a manufacturing fuel.

YORKSHIRE COALFIELD.

Nearly every class of coal occurs in Yorkshire, including house coal, gas coal, hard steam coal, engine coal and coking coal. Speaking generally, the West Yorkshire coals do not coke so well as in South Yorkshire, and some of the seams in the West Riding will not coke at all. In South Yorkshire the BARNSLEY or TOP HARD seam is most worked. This is at its best between Treeton and Royston and South Kirkby. Here the middle portion is steam coal, and the upper and lower parts are bituminous. In a southerly direction it loses the bituminous constituents and becomes throughout a non-coking steam coal. The PARKGATE seam is a high-class gas coal, but becomes a second-rate steam coal towards the north. The SWALLOW WOOD seam becomes a high-class house and gas coal in West Yorkshire. Although the seams generally vary in character in different parts of the district, some retain great uniformity over large areas. Thus the PARKGATE seam of South Yorkshire, which is the same as the DEEP HARD of North Derbyshire, and the SILKSTONE of South Yorkshire, or the BLACK SHALE coal of Derbyshire, retain their character over a large area, being a soft bituminous coal of great purity and an excellent house and coking coal. These are probably the same as the ARLEY MINE seam of Lancashire.

There is a general correspondence between the coal measures of South and West Yorkshire. Thus in each coalfield, besides many minor seams, there are three chief workable seams and two other important beds of somewhat inferior quality. These are:—

In West Yorkshire, STANLEY MAIN seam, HAIGH MOOR seam, MIDDLETON MAIN seam, WARREN HOUSE seam, BEESTON coal.

In South Yorkshire, the BARNSLEY seam, PARKGATE seam, SILKSTONE seam, SWALLOW WOOD seam, THORNCLIFFE THIN seam.

In West Yorkshire, in descending order, the first important seam is the STANLEY MAIN, which yields a large proportion of the West Yorkshire steam coal, exported at Goole and Hull; and is also sold as a second-class house coal. The SCALE coal, lying 20 yards above it, is a good house coal, but not much worked.

The next important bed is the WARREN HOUSE seam, which yields only a second-class steam coal. This seam is known as GAWTHORPE coal in the Ossett district, where it is worked as an engine coal. The WARREN HOUSE seam is supposed to be the same as the BARNSLEY seam of the south.

The HAIGH MOOR seam is a first-class house coal, much worked about Castleford and Pontefract.

The JOAN or MITCHELL coal, FLOCKTON THICK and FLOCKTON THIN seams thin out east of Leeds, but are much worked to the west. The FLOCKTON THICK contains some good cannel at Morley and Batley. FLOCKTON THIN, called also ADWALTON BLACK BED, is a good house coal.

The 36-YARD BAND SEAM furnishes a manufacturing coal around Halifax.

The SHAFTON seam is worked for house and steam coal near Wakefield and Barnsley.

The BLACK BED seam is a gas coal in the Bradford district and near Leeds.

The SHERTCLIFFE seam is used both as house and manufacturing fuel.

The WINTER seam is a house coal at Barnsley.

The CANNEL seam is worked as a gas coal at Liversedge and Batley.

The Upper and Lower BROWN METAL seams are worked as household coals.

The MIDDLETON LITTLE coal, worked about Morley, is a good hard steam coal.

The MIDDLETON MAIN, or so-called Silkstone of West Yorkshire, is the most valuable seam of the district, and is a good house and gas coal.

WHEATLEY LIME coal is of poor quality and only used locally.

BLOCKING coal is a persistent seam, generally of good quality. This seam is believed to represent the Silkstone seam in South Yorkshire.

BEESTON BED is fair house coal.

LOW MOOR BLACK BED is a good class gas coal; rather soft, friable, and dull looking; burns to a red ash, much used as engine coal.

LOW MOOR BETTER BED is a very pure coal. Its freedom from sulphur renders this coal of excellent quality for iron smelting. It is extensively worked in the Low Moor district, near Bradford.

HALIFAX HARD BED, of poor quality, but used as a manufacturing fuel.

HALIFAX SOFT BED, good coal, making first quality coke.

In South Yorkshire, taking the seams in descending order, the SHAFTON coal and the upper seams at Sharlston have been worked locally, but for various reasons have not yet been considered of much commercial value.

The WHINMOOR seam is a gas coal in the Barnsley district.

KENT'S THIN and KENT'S THICK seams, known also as BEAMSHAW coal and MAPPLEWELL coal, are of inferior quality. These overlie the BARNSLEY BED.

BARNSLEY BED, the best known seam in Yorkshire. This bed has also been designated the TOP HARD, ELSECAR and GAWTHORPE coal. This seam derives its value from the fact that in its middle part it is semi-anthracitic, consisting of alternating layers of dull and bright coal, forming the BARNSLEY HARD steam coal, used both for locomotive and smelting purposes. The upper and lower portions of the same seam, which is altogether nearly three yards in thickness, are soft bituminous house coals.

SWALLOW WOOD coal is probably on the same horizon as the HAIGH MOOR seam in West Yorkshire. It is of variable quality, sometimes very good and at other times of little value.

LIDGET coal is a household coal used locally, and of little general value.

FENTON coal is worked as a gas, coking and household coal at Tankersley.

PARKGATE seam is of good quality and ranks next to Barnsley and Silkstone in value in South Yorkshire. Around Sheffield it is a furnace coal, and near Rotherham part of it is a first-class gas coal.

THORNCLIFFE THIN coal is much worked as a steam and furnace coal. In the Barnsley district it is also used for household purposes.

Silkstone seam is worked continuously from Gawthorn on the north, through Derbyshire to Nottingham on the south. At its best it is a very pure bituminous household coal. It is sometimes rather tender, and then makes a first-class gas and coking coal. The Silkstone brights gas coal is a lustrous black coal, with irregular transverse fracture and free from pyrites, swelling up and caking when burnt, and leaving a reddish grey ash. The SILKSTONE HARDS is a stronger coal of very similar character.

MOUNTAIN MINE seams are worked in the neighbourhood ot Todmorden, for house and manufacturing purposes.

LANCASHIRE.

The WIGAN seams include the following:—FOUR-FOOT coal, making good gas coal; INCE YARD coal; INCE FOUR-FOOT coal; INCE SEVEN-FOOT coal; FURNACE MINE; PEMBERTON FIVE-FOOT MINE, hard, free-burning steam coal; PEMBERTON FOUR-FOOT MINE, a bright coal, free from pyrites; WIGAN FIVE-FOOT; CANNEL, best gas coal; KING coal; YARD coal; BONE coal—all of which are used as household and manufacturing coals; SMITH coal; ARLEY MINE, next in value to the Cannel seam—a semi-bituminous, free-burning steam, house and gas coal, leaving considerable ash but no clinker. The WIGAN SIX-FEET seam at Bamfurlong gives steam, gas, house and manufacturing sorts. New seams known as RAMS seam and TRENCHERBONE seam are worked; the latter is used as gas, steam, manufacturing and household coal. The CROMBOUKE seam in West Lancashire is also used for gas, household and manufacturing purposes.

The DOE seam is usually a gas and coking coal, used also for household purposes in the Pendlebury district. Other seams are the BENT YARD, ROYLEY and ARLEY, worked around Oldham for house, manufacturing and gas purposes. Other seams now working are the OLD MAN, gas, house and manufacturing; PLODDER, house and gas; and WHITE MINE, manufacturing.

St. Helens district has beneath several beds of inferior DELF coals; ST. HELENS MAIN coal; FOUR-FEET coal; CANNEL; RAVENHEAD MAIN coal; BASTIOUS MINE; RUSHY PARK coal, for steam and furnace purposes; LITTLE DELF or ARLEY MINE, more bituminous than the above, softer and less bright, used chiefly for smithy purposes and tor coking; the HAYDOCK HIGHER FLORIDA coals, clean and durable, and largely used on ocean steamers, as well as at the Cheshire Saltworks; the FLORIDA MAIN seam—(N.B.—These two seem to be the ST. HELENS MAIN coal and the FOUR-FEET seam respectively). The LITTLE DELF of St. Helens is the ARLEY MINE of Wigan, the RILEY MINE of Bolton, the DOGSHAW MINE of Bury, and the FULLEDGE MAIN coal of Barnsley. This is the lowest coalseam of the Middle coal measures, and is of great economic value.

The Burnley coalfield has the following seams:—DOGHOLE coal, KERSHAW coal, SHELL coal, MAIN coal, MAIDEN coal, LOWER YARD or FIVE-FOOT coal; LOWER BOTTOM or FOUR-FOOT coal, impure cannel, THIN coal, GREAT MINE, CHINA BED, DAUCHY BED, BING seam, DANDY seam, FULLEDGE MAIN coal or ARLEY MINE. These are worked under various names and furnish household, manufacturing and steam varieties.

In the Lower coal measures bordering the coalfield are the "Mountain Mine" seams, including UPPER MOUNTAIN MINE steam coal, LOWER MOUNTAIN MINE steam and coking coal, soft and slow burning, The MIDDLE MOUNTAIN seam of Upholland is a household and steam coal.

CHESHIRE.

Six to ten seams of good thickness and quality, the lowest of which is the REDACRE MINE, identical with the famous ARLEY or ROYLEY MINE of South Lancashire. At Bredbury, near Stockport, the seams include the FIVE-FEET seam (gas coal), BLACK MINE, STONE MINE, PEACOCK or KING WILLIAM coal, SILVER MINE. The WHITE ASH, SWEET seam, and RED ASH coals are also worked for manufacturing purposes.

At Poynton, near the centre of the field, there are manufacturing coals, gas coals and house coals; the chief seams are the REDACRE MINE (representing the Arley Mine of Lancashire); ACCOMMODATION (house and manufacturing coal); REFORM, GEES, TWO-FEET (house and manufacturing coal). A cannel coal seam occurs at Dukinfield and the COLONELS seam is worked as a house coal. At Marple the NEW MINE seam is also a house coal.

NORTH WALES COALFIELD.

The Denbighshire coalfield contains the following seams:—TOP SULPHUROUS coal, or TOP STINKING coal, worked at Wrexham as house and steam coal; BOTTOM SULPHUROUS coal (not worked); SMITH'S coal; DROWSALL coal, a good quality house coal; POWELL coal (representing the Bind coal of Flint), used as house or steam coal; TWO-YARD coal (representing the Hollin coal of Flint), furnace and steam coal; CRANK coal, house coal, worked at Wrexham; BRASSEY coal; MAIN coal—employed as furnace and steam coal: some of the seams in this area are esteemed for household use. The Main coal at Ruabon is a black, laminated bituminous coal, caking on burning and leaving a pale yellow ash.

The FLINTSHIRE coalfield contains the following seams:—FOUR-FOOT coal (cannel); BIND coal; HOLLIN coal, gas coal; CANNEL gas coal; BRASSEY coal; MAIN coal; LOWER FOUR-FOOT coal (in some places cannel), gas coal; WALL and BENCH, house, manufacturing and steam coal.

In Flintshire, gas coals are got from HOLLIN coal, CANNEL and LOWER FOUR-FOOT seam of MOLD. The LEESWOOD CANNEL, Mold, is said to rival the Wigan cannel. The gas coals are limited in area. Thus the HOLLIN coal, which is a gas

coal at Mold in Flintshire, becomes the TWO-YARD coal of Denbigh, where it is used chiefly for steam purposes.

The BAGILLT MAIN seam is used as steam coal, lighting easily and burning freely, but giving off much smoke and soot, with considerable ash and cinder, with little clinker. Other seams worked are the PREMIER, KING COAL and QUEEN COAL, The MOUNTAIN seam worked near Mold at Erith Pit is used for household and steam purposes.

NORTH STAFFORDSHIRE COALFIELD.

There are some good gas and coking coals, but the greater part are dry bituminous coals suitable for household and manufacturing purposes.

POTTERIES COALFIELD.—The following are the chief seams in the lower part of the Potteries Coalfield. The information is mainly derived from the Geological Survey memoir, with additions from the Official List of Mines.

LOWER DIVISION, EASTERN AREA :—MOSS coal is best household coal in Longton district, at Fenton it has a 3 ft. seam of cannel above it ; LITTLE ROW coal is a good house coal ; YARD coal is sold for household and potters' use, and also cokes well ; BIRCHES or OLD WHITFIELD coal is a blast-furnace, steam and manufacturing coal, also used for household purposes ; BELLRINGER or STONY EIGHT-FEET coal is a blast-furnace coal ; TEN-FEET coal is a steam, forge and manufacturing coal, also second-class house coal ; BOWLING ALLEY coal is good manufacturing and house coal ; HOLLY LANE coal is a good house coal ; HARD MINE coal is mainly used for blast furnaces, also a first-class locomotive coal ; SEVEN-FEET BAMBURY coal is a house coal, also used for manufacturing, forge and steam purposes ; COCKSHEAD coal is a first-class house coal, also used for blast furnaces and general manufacturing ; BULLHURST coal is house coal. A prominent feature is the almost total absence of gas and coking coals from the eastern area.

LOWER DIVISION, WESTERN AREA :—FOUR-FEET coal is house coal ; SINGLE FIVE-FEET coal is house coal ; RAGMAN coal is a steam coal ; SEVEN-FEET coal is a house coal ; HAMS coal is steam coal ; TEN-FEET coal is house and gas coal ; SEVEN-FEET BAMBURY coal is a house and gas coal, as are also the EIGHT-FEET and BULLHURST coal ; FOUR-FEET or CRABTREE coal, smithy coal ; WINPENNY coal is not worked here.

In the next division the following seams occur ; they are of less value than those below :—NEW MINE coal, a manufacturing coal ; GIN MINE and TWIST or POTTERY coal ; BIRCHENWOOD coal, a first-class house coal in the Kidsgrove area.

In the HIGHER DIVISION the following seams occur :—BASSEY MINE, used for manufacturing purposes ; PEACOCK coal, LITTLE ROW coal, and SPENCROFT coal, used as potters' coal and in forges ; GREAT ROW coal, used for house, steam, pottery and iron manufacture : it is overlain by cannel coal ; CANNEL ROW coal, used for steam, pottery and second-class house coal. It has cannel coal above it. WINGHAY coal, used for manufacturing purposes ; ASH coal, a good house coal, used also for manufacturing, steam and forge purposes.

In the neighbourhood of Goldendale the following seams are found (descending order):—LITTLE ROW coal, good house coal; YARD coal, not very good; RIDER coal, locomotive steam coal; FOUR-FEET coal, house coal; ROG MAN coal, good house coal; ROUGH SEVEN-FEET coal, good steam coal; SMITHY coal, used by blacksmiths, a good coal for welding; STONY EIGHT-FEET coal, very inferior; TEN-FEET coal, very inferior, manufacturing and steam coal; TWO-ROW (MAGPIE coal), good steam coal and second-class house coal; HOLLY LANE coal, very good house coal; BOWLING ALLEY coal, not very good; SEVEN-FEET BAMBURY, best house and best gas coal; EIGHT-FEET BAMBURY coal, seconds house and gas coal; BULLHURST coal, very good house and gas coal, even superior to Seven-Feet Bambury; WINPENNY coal, best house and gas coal; SILVER MINE coal, good coal.

In the northern part of the coalfield, in the Biddulph Valley, all the coals are open burning, bituminous kinds. The HARD MINE or SPARROW BUTTS coal is here an excellent furnace and steam coal. The SEVEN-FOOT BAMBURY or Froggery coal is a steam coal; the EIGHT-FOOT BAMBURY or NEWPOOL coal is used for furnaces and for second quality house and steam coal. The BULLHURST seam has here too much sulphur for use in iron manufacture, and makes a second class house and steam coal.

In the Audley-Harecastle district the ROUGH SEVEN-FEET coal and STONY EIGHT-FEET coal are steam coals of average quality. The TEN-FEET coal is a highly bituminous coking coal and TWO-ROW coal is an open-burning house coal.

The SEVEN-FEET BAMBURY is a highly-bituminous coking coal, making the best house and gas coal in the district. The EIGHT-FEET BAMBURY coal makes a steam and seconds house coal, and at Talk-o'-th'-Hill, a highly bituminous coking coal. The BULLHURST coal is generally a best house and gas coal in the middle part, the top and bottom being inferior. The best part is a highly bituminous coking coal.

SOUTH STAFFORDSHIRE.

The TWO-FOOT coal is bituminous, and suitable for household and manufacturing purposes.

The BROOCH coal is also a bituminous household coal. It makes good coke, suitable for melting purposes, being very free from sulphur. The FLYING REED coal makes an inferior house coal, but a good forge coal. The THICK coal is a bituminous coal, the top part being the best and strongest. This is used for blast furnaces and also household purposes. The lower part is mostly used for mill and forge purposes, but is occasionally coked. The HEATHEN coal is a bituminous coal used for furnace and second quality house coal. It has also been used for gas-making. The NEW MINE coal is a bituminous coal used for blast furnaces, mill and forge work, tube furnaces and for coking. The BOTTOM coal is a soft coal only used for forge purposes, and a similar use is found for the BOTTOM COAL HOLERS and the MEALY GREY coal.

CHEADLE COALFIELD.

In the Cheadle Coalfield are the following seams:—TWO-YARD coal, HALF-YARD coal, YARD coal, LITTLEY coal, FOUR-FOOT coal, WOODHEAD THREE-FOOT coal.

The lowest coal measures contain the CRABTREE coal, WOODHEAD coal and DILHORNE seam.

DERBYSHIRE COALFIELD.

The principal seams are the LITTLE coal, used as steam coal, MAIN coal, house and manufacturing, WOODFIELD coal, STOCKINGS coal worked at Swadlincote for manufacturing purposes, EUREKA household coal, MICKLEY house coal, and steam varieties.

According to the most recent Geological Survey Memoir,* the seams most commonly worked in the southern part of the Derbyshire and Nottinghamshire coalfield are the TOP HARD, DEEP SOFT, LOWER HARD, FURNACE, BLACK SHALE and KILBURN. The ELL coal, WATERLOO coal and DUNSIL coal have not been much used, although the former is worked for manufacturing purposes at Alfreton and Pinxton, and the latter as a house coal near Mansfield.

The KILBURN coal is an excellent house coal of uniform quality over a large area and believed by Dr. W. Gibson to be the equivalent of the WOODHEAD coal in the Cheadle coalfield.

The BLACK SHALE coal, also called CLOD coal, produces both house and gas coal, but is liable to contain layers of shale, and is sometimes of inferior quality. This seam is the equivalent of the Silkstone seam of Yorkshire, and may be represented by the ALECS or STINKING coal of the Cheadle district.

FURNACE or TUPTON coal is used both for household and steam purposes; sometimes rather soft; worked largely at Alfreton.

PIPER coal is worked around Ilkeston, where the top part is house coal and the lower part is steam coal.

LOWER or DEEP HARD coal is an important seam yielding house and steam coal.

DEEP SOFT coal is a persistent coalseam of best house coal.

TOP HARD coal contains several qualities in separate layers of hard and soft quality. These furnish respectively house coal, blast-furnace coal, steam and manufacturing coal. At the bottom of the seam there is occasionally a valuable seam of cannel, varying in thickness near Chesterfield. The TOP HARD coal is a strong splint coal, very durable and used extensively in iron works.

The COOMBE seam, worked at Brinsley as a manufacturing coal, is about 60 ft. above the TOP HARD seam.

* The Geology of the Southern Part of the Derbyshire and Nottinghamshire Coalfield, by W. Gibson and others, London (1908).

NOTTINGHAM COALFIELD.

The chief workable seams are the TOP HARD, DEEP SOFT, DEEP HARD, KILBURN coal.

At Shirebrook Colliery the following seams occur:—MANOR coal, SHIREOAK, MELTON or BARLBRO' HALL coal, FURNACE coal, HAZLES coal, TOP HARD (or Barnsley) coal, DUNSHILL coal, WATERLOO coal, SOFT coal, LOWER HARD, PIPER coal, FURNACE coal, KILBURN coal.

The TOP HARD and LOWER HARD seams are excessively hard, bright coal; they light easily, and crackle when thrown on fire; they burn freely, leaving a white ash and considerable clinker. The lower bed has more pyrites and greater amount of ash.

LEICESTERSHIRE COALFIELD.

The coals are all of the usual Midland bituminous type, and are employed for domestic, manufacturing, forge and brickmaking purposes.

In the Moira district the chief seams are:—ELL coal; FIVE-FEET coal; LITTLE coal, used as steam coal; MAIN coal, house and manufacturing coal, most important seam; SLATE coal; WOODFIELD coal; STOCKINGS coal (manufacturing), EUREKA coal (household).

In the Coleorton area the seams are:—COLEORTON MAIN and MOIRA, one of principal seams; UPPER and LOWER LOUNTS; LOUNT NETHER—all these are manufacturing coals; ROASTER coal or LOWER MAIN, one of principal seams, used for manufacturing and household purposes.

A few cannel coals occur and are worked with other seams.

At Ibstock, the FIVE-FEET and UPPER MAIN are house coal seams, and the SEVEN-FEET and LOWER MAIN are manufacturing coals.

At Whitwick Colliery the coal gives a firm compact coke.

WARWICKSHIRE COALFIELD.

All the seams are ordinary bituminous coals, suitable for household, steam-raising, and brickburning. The chief seams are:—

FOUR-FOOT, TWO-YARD, RYDER (not in the north), BARE (not in the north), ELL, SLATE, (not in the north). The last four seams are united towards south to one seam, the HAWKESBURY seam. SEVEN-FEET, most persistent seam; DOUBLE or DEEP, BENCH (absent in south).

Much of this coal is used for domestic and manufacturing purposes, the small being used for lime and brick-making. The ELL and TWO-YARD seams sometimes rank as steam coals.

COALBROOKDALE COAL.

Seams most worked are all in Lower Measures, and include FUNGUS coal, TOP coal, DOUBLE coal, YARD coal, BIG FLINT coal, NEW MINE coal, BEST coal, CLOD

and RANDLE coal, LITTLE FLINT coal. All are bituminous coals, used for household, steam-raising and smelting. Some thin sulphurous coals in higher measures are coked for malt kilns, hop-drying, &c. The TOP, YARD, DOUBLE and BIG FLINT coals are used for iron smelting. FUNGUS coal is suitable for general purposes.

FOREST OF WYRE COALFIELD.

Seams resemble those of Coalbrookdale. The Lower Measures yield the "Sweet coal" seams, the Upper Measures the "Sulphur Coal" series.

FOREST OF DEAN COALFIELD.

The coal measures of this area may be divided into three series, representing the three uppermost series of South Wales. The lower measures of South Wales are believed to have thinned out and to be unrepresented in the Forest of Dean. The highest seams are the WOORGREENS series which furnishes house coal, but is not equal in quality to that of the middle series. The Woorgreens coals are the equivalent of the Supra-Llantwit series of Swansea and Neath. The Middle series, beginning 200 yards below the Woorgreens coals, are the equivalent of the Llantwit series of Monmouthshire. The seams include the CROWDER, SMITH, FOOT, LOWERY, STARKEY, ROCKEY, BREADLESS and CHURCHWAY HIGH DELF seams. These yield chiefly household, manufacturing and gas coals. The seams have been considerably worked out.

Below the above is the equivalent of the Pennant series of South Wales, beginning with the BRAZILLY seam, followed by the YORKLEY, WHITTINGTON, COLEFORD HIGH DELF, and ending with the TRENCHARD seam, the lowest seam in this area, and probably to be correlated with the TILLERY seam and NO. 2 RHONDDA of South Wales. These furnish harder coals suitable for steam raising.

SOMERSET COALFIELD.

The upper series are chiefly developed in the southern basin (Radstock). These are believed by Mr. H. K. Jordan to be the equivalent of the Supra-Llantwit series, the highest seams in South Wales.

At Radstock, the chief seams now being worked are the GREAT, TOP, LITTLE, MIDDLE, SLIVING, UNDER LITTLE, BULL, ROCK, NINE-INCH, NO. 5 and NO. 6 veins. These furnish coking, gas, household and manufacturing coals. The gas coals have rather more ash, but otherwise compare well with Durham gas coals.

At Bristol, the ASHTON and BEDMINSTER GREAT VEINS are worked for coking, household and manufacturing coal, and the HARD VEIN is of similar quality.

Below the Radstock series is the Farrington series, believed to be the equivalent of the Llantwit group of South Wales, and worked in the Parkfield and Coalpit Heath district. The chief seams are the CATHEAD, TOP, PEACOCK, MIDDLE, CHURCH CLOSE or NEW VEIN and SEVENTEEN-INCH.

In the Pennant series are the following seams: — MANGOTSFIELD TOP, MANGOTSFIELD MIDDLE, MANGOTSFIELD LITTLE, COCK seam, HEN seam, PARROT, BRIMSTONE. The Pennant series contain good smith's coal in the northern part, changing to house coal in the south at Nettlebridge.

The Lower Coal Measures are divided into the New Rock series above and the Vobster series below. The former are steam and house coal worked chiefly south of the anticlinal. The thickest seams, the Vobster series, are coking coals, containing the following seams:—FERN RAG, STONE RAG, MAIN COAL, STRAP VEIN, PERRINK VEIN, WHITE AXEN VEIN, RED AXEN VEIN, WILMOTS VEIN.

SOUTH WALES COALFIELD.

1.—THE STEAM COAL REGION.

The numerous seams worked in the South Wales Coalfield, and the many different names given to the same seam in different localities, make it difficult to present an adequate summary of their characteristics. The question of correlation, however, has now advanced to such an extent, owing to the recent work of the Geological Survey, and the important researches of Mr. H. K. Jordan, that it is possible partly to overcome this difficulty. For this purpose we adopt the following four-fold division proposed by Mr. Jordan:—

SUPRA-LLANTWIT SERIES, including the GROVESEND and GELLI seams of the Llanelly district.

LLANTWIT SERIES, beginning above with the BIG RIDER seam of Monmouthshire, which is the equivalent of No. 1 Llantwit, and becomes the WERNFFRAITH seam or SWANSEA FOUR-FEET seam in the Swansea and Neath districts.

PENNANT SERIES, including all seams between the MYNYDDISLWYN and the BRITHDIR of Rhymney Valley, or TILLERY seam, and their equivalents referred to below.

LOWER MEASURES, including all seams below the TILLERY seam in Ebbw Vale and Pontypool districts, the equivalent of the RHONDDA No. 2 vein of Treharris and the Rhondda Valley, and the MALTHOUSE seam of the South crop at Tondu.

LLANTWIT SERIES.—The highest seams occur near Gorseinon, where the GROVESEND and GELLI veins are worked as manufacturing and steam coals. Below these comes the WERNFFRAITH, or SWANSEA FOUR-FEET seam, yielding house, steam and manufacturing coal. This seam is the same as No. 1 LLANTWIT, and the NINE-FEET BETTWS, of the Llynfi Valley. At the base of the Llantwit

series in Glamorganshire is the No. 3 Llantwit, which latter is the BETTWS FOUR-FEET of the Tondu district, and the GRAIGOLA or SWANSEA SIX-FEET, of Swansea and Neath. This seam is a valuable house coal at Pontypridd, a house and steam coal at Glais, and a steam coal at Pontardawe. It is believed to be the representative of the MYNYDDISLWYN seam of Monmouthshire.

PENNANT SERIES.—In the Newport area and at Pontypool the highest seam is the MYNYDDISLWYN a bituminous household coal now nearly exhausted. This seam becomes the NO. 3 LLANTWIT at Llantwit, BEDWAS at Caerphilly, BETTWS FOUR-FEET in Llynfi Valley, GRAIGOLA in Neath, SIX-FEET at Swansea, and FIERY seam at Llanelly. At the same time it changes in character westwards from a bituminous coal to a free-burning steam coal, giving a good yield of coke. This is succeeded by the TILLERY vein, the base of the Pennant group, and the same seam that is known as the BRITHDIR in the Rhymney Valley, No. 2 RHONDDA in the Rhondda Valley, YNISARWED in the Vale of Neath, WERNDDU in the Afon Valley, and the MALTHOUSE seam at Tondu. It is generally to be described as a household and manufacturing coal.

These two seams are the best-known bituminous seams, and generally lie above the steam coal seams, but NO. 2 RHONDDA seam illustrates the loss of bituminous matter in a westward direction. Thus in Taff, Cynon and Rhondda valleys it is a bituminous coal, at Glyncorrwg it is a semi-bituminous steam coal, and in the Vale of Neath it becomes a true steam coal. Thus it keeps its character as a house coal to within about 25 miles of the anthracite centre.

The Survey correlates the ROCK FAWR seam of Neath and Swansea with the TILLERY VEIN, but Mr. Jordan makes this the equivalent of No. 3 RHONDDA. It is a rather tender steam coal, excellent for stationary engines, and is used also as a house and manufacturing fuel. Other seams in the Pennant series are the No. 1 RHONDDA and HUGHES VEIN in Neath. The latter is used as a house, manufacturing and steam coal.

In the Taff Valley there are two seams about midway between the MYNYDDISLWYN and NO. 2 RHONDDA. The upper is the DARANDDU and the lower is the CEFN-GLAS. Lower down the valley at Nantgarw are two similar seams, the upper being known as the COEDCAEDYRYS and the lower as the STINKING VEIN. To the west of the Taff Valley these seams are believed by Mr. Jordan to be represented by the MOUNTAIN seam and the WENALLT manufacturing coal (which is the same as the HUGHES VEIN in Neath). The MYNYDDISLWYN seam is here known as the HENDRE-GAREG seam, and occasionally as the GREENWAY or GRAIGOLA seam.

Below the Pennant series, in the lower measures, there is a large number of seams, beginning with the RED VEIN of Neath and the ELLED VEIN of Pontypool and Ebbw Vale, which is the same as the TWO-FEET-NINE VEIN of Rhondda Valley and Treharris. This is succeeded by the BIG VEIN, THREE-QUARTER VEIN and BLACK or RAS-LAS VEIN, MEADOW VEIN and OLD VEIN. At the base of the series is the

GELLIDEG seam of the North crop, known in the South crop as the CRIBBWR-FAWR, and probably representing the OLD coal of Pontypool. These lower seams are the first to show the effect of increasing anthracitisation towards the west. The Survey considers that the BLACK or ROCK VEIN, the RAS-LAS or NINE-FEET VEIN of East Glamorganshire, the NINE-FEET or BIG VEIN of the North crop on the borders of Brecknock, probably the STANLLYD and CARWAY BIG seams of Carmarthenshire, and possibly the TIMBER VEIN of Pembrokeshire, are one and the same seam, and form a convenient datum line for the study of anthracitisation. This seam, if it is really one and the same, shows a progressive change from semi-bituminous steam coals in the eastern portion of the NINE-FEET VEIN at Pontypridd, to steam coals in the same vein between Maesteg and Merthyr, to semi-anthracite in the Vale of Neath and true anthracite in the STANLLYD VEIN of the KIDWELLY district.

For this reason the order of the seams becomes an important index of their quality, for it is frequently the case that in any district the lower the seam the higher is its carbon content. This rule, however, has some important exceptions, as is pointed out in the Survey memoir by Dr. Strahan. The lines of equal anthracitisation, however, form more or less circular arcs, surrounding an area extending from Kidwelly to Glyn Neath. In Pembrokeshire all the coals are anthracitic. These lower seams—viz., those lying below the Pennant series, only remain bituminous house coals until at a distance of 30 or 40 miles from the anthracite centre, when they gradually pass into steam coals, from below upwards, until within about 25 miles of the anthracite centre, when they become progressively anthracites. This loss of bituminous matter is shown in the Survey memoir to be more rapid in a south-to-north direction than in an east-to-west direction. Probably for this reason the lower seams still retain a good deal of their bituminous character as far as the Vale of Neath. Thus, at Port Talbot the NORTH FAWR seam is friable, but makes a good house and steam coal, also useful for manufacturing, and when washed makes first-class coke; the SOUTH FAWR seam is a fairly hard bituminous coal, and a good house and coking coal; the SIX-FEET seam is hard bituminous coal, making a good household coal, and cokes well; the NINE-FEET seam is a soft bituminous coal of inferior quality; the CRIBBWR FAWR seam is a most valuable house coal, and first-class coking and steam coal; the BODDWR VAWR is a tender coal, but makes excellent coke of great repute for iron manufacture. In the Dulais Valley, the BIG or NINE-FEET VEIN and the BRASS VEIN are more anthracitic than in the Vale of Neath, and when picked free from pyrites are used for malting.

In the northern part of the field, however, it is in the Pennant series that the house and coking coals occur, while the Lower series contains the well-known Welsh steam coals, which at Aberdare include the TWO-FEET-NINE, FOUR-FEET, NO. 1 YARD, SIX-FEET, RED COAL, NINE-FEET, BUTE, NO. 2 YARD, SEVEN-FEET, and NO. 3 YARD. The first of these—the TWO-FEET-NINE—as stated above, is probably the same seam as the ELLED seam, a bituminous seam in Monmouthshire; it is also believed to represent the STWRAIN seam of the Amman Valley. The FOUR-FEET

steam coal seam of Aberdare is the same as the Monmouthshire BIG VEIN, and the SIX-FEET seam of Aberdare is the THREE-QUARTER of Monmouthshire, and is probably the same as the EIGHTEEN-FEET seam of the Vale of Neath. The NINE-FEET of Aberdare is considered to be the BLACK VEIN of Monmouthshire, the RAS-LAS of Rhymney and Dowlais, the BYDYLOG of Ebbw Vale, the BIG VEIN of Amman Valley and the STANLLYD of Gwendraeth Valley. This vein furnishes the best Monmouthshire steam coal, possessing good heating qualities, burning with a bright flame, making a clean fire and yielding coke of good quality.

Mr. T. Forster Brown has thus generally described the character of South Wales coalseams. Generally all the coalseams west of Carmarthen Bay are anthracitic. Eastwards, the Gower seams and the upper seams of Llanelly, as well as nearly all the coals of the white ash series south and east of a line drawn from Gower River to Neath, Cymmer, Ystrad, Ferndale, Navigation and Merthyr, are more or less bituminous—the same seams north and west of that line being steam coals in the Aberdare and Rhondda districts, changing gradually to anthracite west of the Vale of Neath.

There is every gradation between the different varieties, and good coking coal occurs between the bituminous and semi-bituminous or steam coals.

2.—THE ANTHRACITE REGION.

In Pembrokeshire the chief seams are the ROCK VEIN, TIMBER VEIN and BONNEY VEIN (equal Stinkard Vein). These are the best quality anthracite, but the seams are often thin. The LOW-LEVEL and KILGETTY are the two seams most worked, producing hard anthracite with large proportion of large coal. Most of the other seams produce chiefly small coal, much used for house purposes locally, and the large coal is shipped for malting.

In the GWENDRAETH Valley (Carmarthen), the chief seams are the BIG VEIN, STANLLYD and PUMP QUART. These are harder than the Pembroke seams, but have less carbon, and are somewhat inferior near Llanelly. Towards the north-east, although not so good as Pembroke in quality, they are well adapted for malting.

In the Cwmmawr Valley (Carmarthen and Brecon), the BIG VEIN (representing the Stanllyd of above area), has the best reputation. The BRASS VEIN is of excellent quality, as also is the DIAMOND VEIN. The FURNACE or FOUR-FEET seam is largely used for iron smelting. Further eastwards in this valley the coals get rather inferior, with less carbon, but are hard and suitable for lime burning.

In West Glamorgan BLACK VEIN, YNISARWED, MIDDLE VEIN, RED VEIN, TRIGLONEN VEIN, BIG VEIN, PEACOCK VEIN, BLEUKS, THREE-FEET, EIGHTEEN-FEET and NINE-FEET seams are worked as anthracite.

THE IRISH COALFIELDS.

LEITRIM.

In the Arigna coalfield there are three seams of bituminous coal, of which the Top seam is most valuable. The Top seam at Aughabehy is a rich; black coal, easily broken, giving off much gas and yielding a porous coherent coke. The Rover coal is less bituminous, and gives a less coherent coke.

TYRONE.

The Dungannon coalfield contains the following workable seams in the Coal Island series:—Annagber seam, a soft quality coal; Bone coal; Shining seam; Brackaville seam, good quality bituminous coal; Gortnaskea coal, with 22 in. seam of cannel containing very little ash; Beltiboy coal, rather sulphurous. Then there is the Derry coal, good quality bituminous coal; Yard coal, good quality bituminous coal; Greenagh coal, with 14 in. of cannel, and the Drumglass series, consisting of the Main coal of Drumglass, variable quality; Lower coal of Drumglass. All the above seams are highly bituminous, and, with the exception of the Derry coal, are good gas coals. Their heating power is high.

ANTRIM.

At Ballycastle three seams occur, Top or First coal, known as the Splint seam, the Hawksnest seam and the Main seam. The coals are dull, black and bituminous, giving off much gas, and making a porous coke.

LEINSTER.

In the Castlecomer district there are several seams ot anthracite coal, of which the Double seam, Three-Foot and Five-Foot coals are the thickest.

The coal of the Slievardagh coalfield in Tipperary is chiefly anthracite. The Rushes and Pollough are the best known seams.

MUNSTER.

At Kanturk, in co. Cork, the Sweet Vein has been worked. It is an anthracite of similar quality to the above. Other seams in this area are softer and more slaty than in the Leinster coalfield.

ANALYSES

OF

BRITISH COALS AND COKE.

PART I.—COALS.

CHESHIRE.

Notes.

BREDBURY COLLIERY COMPANY LIMITED,

Bredbury, near Stockport.

Colliery—LINGARD LANE, Five Feet Seam, No. 1 Pit.
Shipping Port—Partington Docks, Manchester Ship Canal.
Rail—Great Central and Midland Joint, Bredbury Station.
Canal— . . . .

Arden Screened Gas Coal.

Class of Coal—Gas.

Purified gas per ton	10,115 cubic feet.
Illuminating power	18·39 standard candles.
Weight of coke	$14\frac{1}{2}$ cwt.
Quality	good.
Liquor	33 gallons.
Tar	16 gallons.
Sulphuretted hydrogen	1,014 grains.

Heating power, 12·92 lb. water at 212 degs. Fahr. evaporated by the combustion of 1 lb. of coal.

Analyst— . . . .
Date of Analysis—February 17, 1906.

Notes.

CHESHIRE.

RT. HON. LORD VERNON,

Poynton, near Stockport.

Colliery—POYNTON, ... Seam, Quarry Pit.
Shipping Port—Partington.
Rail—L. and N.W. and Great Central, Poynton Station.
Canal—Great Central (Macclesfield Canal).

Two-feet Coal.

Class of Coal—Manufacturing and Gas.

This seam is from 1 ft. 10 in. to 2 ft. in thickness, and is a bituminous coal suitable for manufacturing purposes and as a gas coal.

Specific gravity	1·285
Purified gas per ton	10,400 cubic feet.
Illuminating power of gas	20·740 standard candles
Illuminating matter in terms of sperm per ton	739·520 lb.
Coke per ton	1,437 lb.
Coke per cent.	64·150 per cent.
Fixed carbon in coke	86 per cent.
Ash in coke	4 per cent.
Sulphur in coal	1·310 per cent.

Calorimetric value—equal to evaporation of 14·30 lb. of water from 212 degs. Fahr. by combustion of 1 lb. of coal.

Analyst—E. L. Newbigging.
Date of Analysis—October 1903.

Colliery.—POYNTON, ... Seam, Park Pit.

Gees Coal.

Class of Coal—House and Gas.

This seam is from 3 ft. 5 in. to 3 ft. 8 in. thick, and is a bituminous coal, suitable for house coal and as a gas coal.

Specific gravity	1·272
Purified gas per ton	10,600 cubic feet.
Illuminating power of gas	19·040 standard candles
Illuminating matter in terms of sperm per ton	691·960 lb.
Coke per ton	1,484 lb.
Coke per cent...	66·250 per cent.
Fixed carbon in coke	96 per cent.
Ash in coke	4 per cent.
Sulphur in coal	0·930 per cent.

Calorimetric value, equal to evaporation of 14·30 lb. of water from 212 degs. Fahr. by combustion of 1 lb. of coal.

Analyst—E. L. Newbigging.
Date of Analysis—October 1903.

Cheshire.

Notes.

Colliery—Poynton, ... Seam, Anson Pit.

Reform Coal.

Class of Coal—Steam and Gas.

This seam is from 2 ft. 6 in. to 2 ft. 8 in. thick, and is a bituminous coal used for steam-raising and gas-making.

Specific gravity	1·285
Purified gas per ton	10,500 cubic feet.
Illuminating power of gas	20·520 standard candles.
Illuminating matter in terms of sperm per ton	738·720 lb.
Coke per ton	1,484 lb.
Coke per cent...	66·250 per cent.
Fixed carbon in coke	94 per cent.
Ash in coke	6 per cent.
Sulphur in coal	0·900 per cent.

Calorimetric value, equal to evaporation of 14·57 lb. of water from 212 degs. Fahr. by combustion of 1 lb. of coal.

Analyst—E. L. Newbigging.
Date of Analysis—October 1903.

Colliery—Poynton, ... Seam, Lawrance Pit.

Accommodation Coal.

Class of Coal—House and Gas.

This seam is from 7 ft. to 7 ft. 6 in. thick, and is a bituminous coal suitable for house use and as a gas coal.

Specific gravity	1·293
Purified gas per ton	10,850 cubic feet.
Illuminating power of gas	20·100 standard candles.
Illuminating matter in terms of sperm per ton	747·720 lb.
Coke per ton	1,391 lb.
Coke per cent...	62·090 per cent.
Fixed carbon in coke	92 per cent.
Ash in coke	8 per cent.
Sulphur in coal	1·800 per cent.

Calorimetric value equal to evaporation of 14·30 lb. of water from 212 degs. Fahr. by combustion of 1 lb. of coal.

Analyst—E. L. Newbigging.
Date of Analysis—October, 1903

Notes.

CUMBERLAND.

ALLERDALE COAL COMPANY LIMITED,

Workington.

Colliery—ALLHALLOWS . . . . Seam . . . . Pit.
Shipping Port—Maryport.
Rail—Maryport and Carlisle, Mealsgate Station.
Canal— . . . . . .

Allhallows Coal.

Class of Coal—Gas.

		Per cent.
Volatile matters, containing 0·75 per cent. sulphur		25·75
Coke, consisting of—		
Carbon	67·81	
Sulphur	0·54	
Ash	3·90	
		72·25
Water expelled at 212 degs.		2·00
		100·00

Gaseous products—	
Gas per ton of coal	10,900 cubic feet.
Gas from 1 cubic foot of coal	393·5 cubic feet.
Illuminating power of the gas in standard candles	17·42 candles.
Value of 1 cubic foot of gas in sperm	425·3 grains.
Value of gas from 1 ton of coal, in sperm	662·3 lb.
Hydrocarbons absorbed by bromine	6·3 per cent.
Sulphuretted hydrogen (H_2S) in foul gas	5·0 per cent.
Carbonic acid (CO_2) in foul gas	1·9 per cent.
Carbonic oxide (CO) in foul gas	0·3 per cent.
Sulphur eliminated with volatile products per ton of coal	16·8 lb.
Liquid products—	
Tar per ton of coal	17·5 gallons.
Ammoniacal liquor per ton of coal	12·4 gallons.
Strength of ammoniacal liquor	2 4 degs.
Hygrometric water per ton of coal	4½ gallons.
Solid products—	
Coke per ton of coal	1,482½ lb.
Carbon in the coke	94·00 per cent.
Ash in the coke	5·40 per cent.
Sulphur in the coke per ton of coal	11·08 lb.

CUMBERLAND.

Notes.

Lustrous black mixed with dull black; breaks easily; traces of pyrites and carbonate of lime; specific gravity, 1,291 (water 1,000); 1 cubic foot weighs 80¾ lb.; coke of fair quality; colour of ash, light fawn.

Analyst—J. Hepworth.

Date of Analysis— . . . . . .

Colliery . . . . . . Seam . . . . . . Pit.

Shipping Port—Workington.

Rail—Cleator and Workington Junction, Great Broughton Station.

Canal— . . . . .

Little Main Coal.

Class of Coal—Gas.

		Per cent.
Volatile matters (containing 0·95 per cent. sulphur)		28·25
Coke, consisting of—		
Carbon	63·04	
Sulphur	0·96	
Ash	3·60	
		67·60
Water expelled at 212 degs.		4·15
		100·00

Gaseous products—

Gas per ton of coal	9,600 cubic feet.
Gas from 1 cubic foot of coal	351 cubic feet.
Illuminating power of the gas, in standard candles	15·82 candles.
Value of 1 cubic foot of gas, in sperm ..	379·6 grains.
Value of gas from 1 ton of coal, in sperm	520·6 lb.
Hydrocarbons absorbed by bromine ..	2·3 per cent.
Sulphuretted hydrogen (H_2S) in foul gas	3·2 per cent.
Carbonic acid (CO_2) in foul gas	2·0 per cent.
Carbonic oxide (CO) in foul gas	6·1 per cent.
Sulphur eliminated with volatile products, per ton of coal	6·01 lb.

Liquid products—

Tar per ton of coal	20¼ gallons.
Ammoniacal liquor per ton of coal ..	17¼ gallons.

Notes.

CUMBERLAND.

Little Main Coal—*cont.*

Solid products—

Coke per ton of coal	1,480 lb.
Carbon in the coke	94·6 per cent.
Ash in the coke	5·4 per cent.
Sulphur in the coke per ton of coal ..	21·5 lb.

Specific gravity, 1,312 (water 1,000); 1 cubic foot weighs 82 lb.; coke, good for fuel.

Analyst—J. Hepworth.

Date of Analysis— . . . . . .

ALSTON AND NENTFORCE LIMESTONE QUARRY COMPANY,

10, Neville Street, Newcastle-on-Tyne.

Colliery—BLAGILL . . . . . . Seam . . . . . . Pit.

Shipping Port— . . . . . .

Rail—North Eastern, Alston Station.

Canal— . . . . . .

"Crow" Coal.

Class of Coal—Manufacturing.

The Alston and Nentforce Limestone Quarry Company work the "Crow" coal of the mountain limestone district of Alston.

	Per cent.
Moisture	3·72
Volatile matter	12·93
Fixed carbon	76·88
Ash	6·47
	100·00

This analysis was made at the Durham College of Science, and the professor of geology at the same college expressed the following opinion :—"This is obviously very near the composition of an anthracite—shows more fixed carbon, in fact, than many semi-anthracites. The amount of moisture is rather strange in so ancient a coal, unless the specimen was very long exposed upon the surface. The ash is exceedingly ferruginous."

Analyst— . . . . . .

Date of Analysis— . . . . . .

CUMBERLAND.

Notes.

SIR JAMES BAIN & COMPANY,

Harrington.

Colliery—HARRINGTON, Six Quarter Seam, No. 9 Pit.

Shipping Port—Harrington.

Rail—L. and N. W., Harrington Station.

Canal— . . . . . .

Harrington Gas Coal.

Class of Coal—Gas.

		Per cent.
Volatile matters (containing 1·75 per cent. sulphur)		32·68
Coke, consisting of—		
Carbon	62·57	
Sulphur	0·50	
Ash	3·00	
		66·07
Water expelled at 212 degs.		1·25
		100·00

Gaseous products :—	
Gas per ton of coal	10,520 cubic feet.
Gas from 1 cubic foot of coal	376·2 cubic feet.
Illuminating power of the gas in standard candles	16·39 candles.
Value of 1 cubic foot of gas in sperm ..	393·36 grains.
Value of gas from 1 ton of coal in sperm	591·16 lb.
Hydrocarbons absorbed by bromine ..	5·2 per cent.
Sulphuretted hydrogen (H_2S) in foul gas	2·1 per cent.
Carbonic acid (CO_2) in foul gas	3·1 per cent.
Sulphur eliminated with volatile products, per ton of coal	15·01 lb.
Liquid products :—	
Tar per ton of coal	13·75 gallons.
Ammoniacal liquor per ton of coal ..	11·96 gallons.
Strength of ammoniacal liquor	2·8 degs.
Hygrometric water per ton of coal ..	2·80 gallons.
Solid products :—	
Coke per ton of coal	1,480 lb.
Carbon in the coke	94·70 per cent.
Ash in the coke	4·54 per cent.
Sulphur in the coke per ton of coal ..	11·20 lb.

A mixture of coal, with small seam of shale; fracture, slaty; cross-fracture, conchoidal. It contains very slight traces of pyrites and of carbonate of lime. Specific gravity, 1,282 (water, 1,000); 1 cubic foot weighs 80·1 lb.; coke, fair; colour of ash, red.

Analyst—J. Hepworth.

Date of Analysis—April 21, 1893.

Notes.

CUMBERLAND.

Mr. JOSEPH HARRIS,

Brayton Domain Colliery, Brayton, S.O.

Colliery—BRAYTON DOMAIN, Yard Band Seam, No. 4 Pit.
Shipping Port—Maryport, Silloth.
Rail— . . . . , Brayton Station.
Canal— . . . .

Brayton Domain Gas Coal (Screened).

Class of Coal—Gas, Steam, Manufacturing and House

		Per cent.
Volatile matters (containing 0·16 per cent. sulphur)		36·10
Coke consisting of –		
Carbon	56·81	
Sulphur	0·44	
Ash	4·40	
		61·65
Water expelled at 212 degs.		2·25
		100·00

Gaseous products—

Gas per ton of coal	11,600 cubic feet.
Gas from 1 cubic foot of coal	404·65 cubic feet.
Illuminating power of the gas in standard candles	15·82 candles.
Value of 1 cubic foot of gas, in sperm ..	397 grains.
Value of gas from 1 ton of coal, in sperm	597·76 lb.
Hydrocarbons absorbed by bromine ..	4·4 per cent.
Sulphuretted hydrogen (H_2S) in foul gas	5·0 per cent.
Carbonic acid (CO_2) in foul gas	2·5 per cent.
Carbonic oxide (CO) in foul gas	2·6 per cent.
Sulphur eliminated with volatile products, per ton of coal	3·58 lb.

Liquid products—

Tar per ton of coal	18·7 gallons.
Ammoniacal liquor per ton of coal ..	12·5 gallons.
Strength of ammoniacal liquor	2½ degs.

Solid products—

Coke per ton of coal..	1,360 lb.
Carbon in the coke	92·81 per cent.
Ash in the coke	7·19 per cent.
Sulphur in the coke per ton of coal ..	9·85 lb.

The section of coal consisted of layers of lustrous black coal and dull black splint coal; the latter broke with an irregular fracture and

CUMBERLAND.

Notes.

was very close and compact. There were few traces of carbonate of lime, but no pyrites. Specific gravity 1,295 (water 1,000); 1 cubic foot=80·93 lb. The coke is of very fair quality, and owing to the small quantity of ash it contains, it will be good for domestic or manufacturing purposes.

Analyst—J. Hepworth.

Date of Analysis—February and March, 1893.

Messrs. THOMPSON & SONS,

Kirkhouse, Brampton Junction.

Colliery—BLENKINSOPP, "Byron" Seam, Byron Pit.

Shipping Port—Silloth.

Rail—North Eastern, Greenhead Station.

Canal— . . . .

"Byron" Gas Coal.

Class of Coal—Gas, House and Steam.

		Per cent.
Volatile matters (containing 0·19 per cent. sulphur)		29·30
Coke, consisting of—		
Carbon	61·77	
Sulphur	0·38	
Ash	4·80	
		66·95
Water expelled at 212 degs.		3·75
		100·00

Gaseous products—

Gas per ton of coal	10,833 cubic feet.
Gas from 1 cubic foot of coal	353 cubic feet.
Illuminating power of the gas in standard candles	17·10 candles
Value of 1 cubic foot of gas, in sperm	410·4 grains.
Value of gas from 1 ton of coal, in sperm	635·1 lb.
Hydrocarbons absorbed by bromine	4·00 per cent.
Sulphuretted hydrogen (H_2S) in foul gas	0·12 per cent.
Carbonic acid (CO_2) in foul gas	1·10 per cent.
Carbonic oxide (CO) in foul gas	0·57 per cent.
Sulphur eliminated with volatile products, per ton of coal	4·35 lb.

Notes.

CUMBERLAND.

"Byron" Gas Coal—*cont.*

Liquid products—

Tar per ton of coal	6·25 gallons.
Ammoniacal liquor per ton of coal ..	6·50 gallons.
Strength of ammoniacal liquor	3·00 degs.
Hygrometric water per ton of coal ..	8·40 gallons.

Solid products—

Coke per ton of coal..	14 cwt. 2 qrs. = 1,624 lb
Carbon in the coke	92·95 per cent.
Ash in the coke	7·05 per cent.
Sulphur in the coke per ton of coal ..	8·51 lb.

Coke very hard and spongy; of superior quality.

Illuminating power tested with Bray's No. 8 U.J.

Analyst—J. Hepworth.

Date of Analysis—June 24, 1884.

WHITEHAVEN COLLIERY COMPANY,

Whitehaven.

Colliery—WHITEHAVEN, Main Band Seam, William, Wellington and Croft Pits.

Shipping Port—Whitehaven.

Rail—Furness, and L. and N. W., Whitehaven Station.

Canal— . . . . . .

Whitehaven Coal.

Class of Coal— . . . . . .

From the Earl of Lonsdale's Whitehaven Collieries, leased to and worked by the Whitehaven Colliery Company; containing all the seams of the Cumberland Coalfield, only two of which—the Main Band and Bannock Band—are at present worked.

	Sample as received. Per cent.	Dried at 212° F. Per cent.
Fixed carbon	62·96	64·84
Volatile matter	32·04	33·00
Sulphur	0·64	0·66
Ash	1·46	1·50
Moisture	2·90	—
	100·00	100·00

Calorific power by Thomson's calorimeter .. 14·3 lb.

CUMBERLAND.

Notes.

The calorific power represents the number of pounds of water at 212 degs. Fahr. which would be evaporated if the whole of the heat produced by the combustion of 1 lb. of the moisture-free coal were conveyed to the water.

Analyst—Robert Hellon.

Date of Analysis—October 15, 1903.

Whitehaven Coal.

Class of Coal— . . . . . .

The coal is strong bituminous coal with high calorific power.

Calorific power of coal dried at 212 degs. Fahr. 14·705 B.T.U.

Raw coal yields—	Per cent.
Fixed carbon	62·5
Volatile matter	32·8
Ash	4·25
Moisture	3·00

Analysts—Snelus and Son.

Date of Analysis—September 17, 1894.

Notes.

DERBYSHIRE.

THE DINNINGTON MAIN COAL COMPANY LIMITED,

Chesterfield.

Colliery—DINNINGTON MAIN, Rotherham, Barnsley Seam.
Shipping Ports—Hull, Grimsby, Goole, Boston, Lynn, Manchester Ship Canal, Liverpool, &c.
Rail—S.Y.J L., Dinnington and Laughton Station.
Canal—*Nil.*

Barnsley Seam Hard Coal.

Class of Coal—Steam.

Approximate average analysis :—	Per cent.
Fixed carbon	65
Volatile matter	28
Ash	3·5
Commercial analysis—	
Specific gravity	1·280
Purified gas per ton	10,400 cubic feet
Illuminating power of gas in standard sperm candles	25·22 candles
Illuminating matter per ton	899·27 lb. sperm
Coke per ton	1,446 lb.
Coke per cent.	64·55
Fixed carbon in coke	88·5 per cent.
Ash in coke	10·0 per cent.
Sulphur in coal	·75 per cent.

Analyst—G. W. Marshall.
Date of Analysis—July, 1908.

HARDWICK COLLIERY COMPANY LIMITED,

Heath, Chesterfield.

Colliery—HARDWICK, Cavendish or Tupton Seam, Holmewood Pit.
Shipping Ports—Hull, Grimsby, Lynn, Partington and Liverpool.
Rail—Midland, Great Central, L. and N. W., Great Northern, Heath Station, Great Central.
Canal— . . . .

Hardwick Cavendish Bright Gas Coal.

Class of Coal—Gas.

A sample of this coal, representing the entire product of the seam, gave on examination the following results :—

The coal is black, possesses considerable lustre and brown streak, fracture fairly regular and defined by thin deposits of charcoal ; cross-

DERBYSHIRE.

Notes.

fracture angular, and resinoid to crystalline, columnar in natural partings, and containing slight deposits of calcium carbonate and ferric bisulphide, moderately cohesive and compact; under distillation it intumesces and agglomerates. Colour of ash, dark brown. Mean specific gravity 1,244 (water 1,000). Weight of 1 cubic foot, 77·75 lb.

		Per cent.
Volatile matters (containing 0·63 of sulphur)		33·87
Coke, consisting of—		
Carbon	58·04	
Sulphur	0·24	
Ash	3·59	
		61·87
Water expelled at 212 degs. Fahr... ..		4·26
		100·00

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar. press.	12,095 cubic feet
Gas from 1 cubic foot of the coal	415·35 cubic feet
Specific gravity of the gas	485 (air 1,000)
Hydrocarbons absorbed by bromine ..	5·75 per cent.
Durability of 1 cubic foot by 5 in. jet flame	47 min. 16 sec.
Value of 1 cubic foot of gas in sperm ..	510·24 grains
Value of gas from 1 ton of coal in sperm	881·62 lb.
Illuminating power of gas in standard candles (per London Argand)	21·26 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·75 per cent.
Carbonic acid (CO_2) in foul gas	2·25 per cent.
Carbonic oxide (CO) in foul gas	6·50 per cent.
Sulphur eliminated with volatile products	14·11 lb.
Liquid products—	
Tar per ton of coal	15·17 gallons
Ammoniacal liquor per ton of coal ..	16·40 gallons
Strength of ammoniacal liquor	3·00 degs. Twadd.
Hygrometric water per ton of coal ..	9·44 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	6·60 per cent.
Solid products—	
Coke per ton of coal	1,385·88 lb.
Carbon in the coke	94·20 per cent.
Ash in the coke	5·80 per cent.
Sulphur in coke per ton of coal	5·37 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)..	12·93 lb.

Notes.

DERBYSHIRE.

Hardwick Cavendish Bright Gas Coal—*cont.*

This gas and coking coal is easily distilled, yields a large amount of illuminating matter, and affords 12·37 cwt. per ton of first-class coke. The foul gas at same time contains a moderate percentage of impurities. Compared with Main Lesmahagow Cannel Coal, represented by 100 (calculated on the bases of a production of 13,000 cubic feet of gas, and 1,535·5 lb. of sperm value per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 64·59.

Analyst—Geo. R. Hislop.

Date of Analysis—March 7, 1903.

Colliery—HARDWICK, Silkstone or Blackshale Seam, Holmewood and Williamsthorpe Pits.

Hardwick Silkstone or Blackshale Gas Coal.

Class of Coal—Gas.

A sample of this coal, representing the entire product of the seam, gave on examination the following results :—

The coal is black, possesses considerable lustre and brown streak, fracture rather irregular with deposits of charcoal and partly laminated; cross-fracture highly angular, hackly, and resinoid to crystalline, in natural partings inclines to columnar and striated with deposits of calcium carbonate and ferric bisulphide, cohesive and compact; under distillation it intumesces and agglomerates. Colour of ash, dark brown. Mean specific gravity 1,228 (water 1,000). Weight of 1 cubic foot, 76·75 lb.

		Per cent.
Volatile matters (containing 0·65 of sulphur)		34·14
Coke, consisting of—		
Carbon..	59·28	
Sulphur	0·18	
Ash	2·10	
		61·56
Water expelled at 212 degs. Fahr.		4·30
		100·00

Derbyshire.

Notes.

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar. press.	12,370 cubic feet
Gas from 1 cubic foot of the coal	423·83 cubic feet
Specific gravity of the gas	480 (air 1,000)
Hydrocarbons absorbed by bromine ..	5·50 per cent.
Durability of 1 cubic foot by 5 in. jet flame	45 min. 48 sec.
Value of 1 cubic foot of gas in sperm ..	496·32 grains
Value of gas from 1 ton of coal in sperm	877·06 lb.
Illuminating power of gas in standard candles (per London Argand)	20·68 standard candles
Sulphuretted hydrogen (H_2S) in foul gas	1·75 per cent.
Carbonic acid (CO_2) in foul gas	2·20 per cent.
Carbonic oxide (CO) in foul gas	6·50 per cent.
Sulphur eliminated with volatile products	14·56 lb.
Liquid products—	
Tar per ton of coal	15·40 gallons
Ammoniacal liquor per ton of coal ..	16·00 gallons
Strength of ammoniacal liquor	3·25 degs. Twadd.
Hygrometric water per ton of coal ..	9·63 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	6·73 per cent.
Solid products—	
Coke per ton of coal	1,378·94 lb.
Carbon in the coke	96·60 per cent.
Ash in the coke	3·40 per cent.
Sulphur in coke per ton of coal	4·03 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	13·27 lb.

The foregoing results prove this to be a remarkably good gas and coking coal, yielding, as it does, a large volume of 20·68 candle gas, and at the same time 12·31 cwt. per ton of exceptionally pure coke. Compared with Main Lesmahagow cannel coal represented by 100 (calculated on the bases of a production of 13,000 cubic feet of gas and 1,535·5 lb. of sperm value per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 63·86.

Analyst—Geo. R. Hislop.

Date of Analysis—March 7, 1903.

Notes.

DERBYSHIRE.

MANNERS COLLIERY COMPANY LIMITED,

Ilkeston.

Colliery—MANNERS, Piper and Low Main Seams, Kilburn Pit.
Shipping Ports—Hull, Goole, Lynn, Partington.
Rail—Midland, Great Northern, L. and N. W., Great Central, Ilkeston Station.
Canal— . . . . . .

Kilburn Coals.

Class of Coal— . . . . . .

	Peas.	Slack.	Smudge.	Small nuts.
Water	5·96	2·82	7·37	6·56
Sulphur	1·95	2·14	2·13	2·04
Ash	3·65	3·44	9·20	3·00
Calorific value in B.T.U.'s	14,247	14,527	13,308	13,778

Analyst—S. R. Trotman.

Date of Analysis—May 1906.

Kilburn Small Nuts.

Class of Coal—House and Manufacturing.

	Per cent.
Carbon	75·00
Hydrogen	4·99
Ash	3·00
Sulphur	2·04
Nitrogen	1·04
Calorific power in B.T.U.'s	13,778

Analyst—S. R. Trotman.

Date of Analysis—1905.

Colliery—MANNERS, ... Seam, Rutland Pit.

Low Main Coal.

Class of Coal—House, Gas and Manufacturing.

Make of gas per ton	10,400 cubic feet
Illuminating power	14½ candles
Non-volatile matters, including coke	54·5
Volatile matters, including water	45·5

Notes.

DERBYSHIRE.

A complete ultimate analysis of the coal was made, and the following results obtained :—

	Per cent.
Carbon	67·93
Hydrogen	4·45
Oxygen	10·16
Nitrogen	1·22
Sulphur	0·62
Ash	3·84
Water	11·78

Analysts—J. and H. S. Pattinson.

Date of Analysis—1904.

Rutland Coals.

Class of Coal— . . . . . .

	Piper hards.	Bakers' nuts.
Carbon	73·80	74·49
Hydrogen	4·56	4·78
Nitrogen	1·08	1·42
Oxygen	13·33	13·80
Sulphur	1·67	1·61
Ash	5·56	3·90
	100·00	100·00
Coke	56·70	57·36
Volatile matter	43·30	42·64
Calorific value in B.T.U.'s	13,009	13,455

Analyst—S. R. Trotman.

Date of Analysis—May, 1906.

Rutland Gas Coal.

Class of Coal—Gas.

Make of gas per ton at N.T.P.	10,700 cubic feet
Illuminating power	16½ candles
Coke per ton	11½ cwt.
Volatile matter	42·5
Fixed matter	57·5
Ash	4·20

The coke is of good quality.

Analyst—S. R. Trotman.

Date of Analysis—1905.

Notes.

DERBYSHIRE.

THE MAPPERLEY COLLIERY COMPANY LIMITED,

Mapperley, near Derby.

Colliery—MAPPERLEY, Deep Hard Seam.
Shipping Ports—Eastern Ports.
Rail—Midland, Stanton Gate Station.
Canal—*Nil.*

Mapperley Steam Coal.

Class of Coal—Steam.

	Per cent.
Fixed carbon	57·86
Volatile hydrocarbons	40·10
Ash	1·50
Sulphur	0·54
	100·00
Calorific power	7,700 calories
British thermal units	13,860
Evaporative power	14·83

Analyst—W. H. Jackson.
Date of Analysis—1905.

Colliery—MAPPERLEY, Kilburn Seam.

Mapperley House Coal.

Class of Coal—House.

Approximate analysis—

	Per cent.
Moisture in coal	1·16
Sulphur	0·93
Volatile matters	42·24
Fixed carbon	52·84
Ash	2·83
	100·00

Commercial analysis—

Purified gas per ton of coal (average)	10,400 cubic feet
Gas per cubic foot of coal	376·13 cubic feet
Illuminating power of gas consumed in a London standard Argand	17·95 sperm candles
Value of 1 cubic foot in sperm	431 grains
Weight of illuminating matter in sperm	640·34 lb.
Weight of coke per ton of coal	1,268 lb.
Percentage of coke in coal	56·60
Ash in coke	5·50 per cent.
Weight of sulphur per ton of coal	20·83 lb.

Analyst—James Paterson.
Date of Analysis—1891.

Notes.

DERBYSHIRE.

MICKLEY COAL CO. (DRONFIELD) LTD.,

Dronfield, Sheffield.

Colliery—MICKLEY, ... Seam, ... Pit.
Shipping Ports—Hull, Goole.
Rail—Midland, Dronfield and Dore-and-Totley Stations.
Canal— . . . . .

Mickley Thin Seam Coal.

Class of Coal—Gas and Coking.

The following are the results of my examination of the sample of coal marked Mickley Thin Seam, from Mickley Colliery, Dronfield, received from you 29th ult:—

Purified gas per ton	11,052 cubic feet
Illuminating power of gas	18·8 standard sperm [candles.
Illuminating matter, in sperm per ton ..	712·0 lb.
Coke per ton	12·6 lb.
Coke per cent.	63·0 per cent.
Ash in coke	2·54 per cent.

This is an excellent gas coal.

It should be noted that the coke is exceptionally low in ash.

Analyst—Wm. McD. Mackey.

Date of Analysis—July 5, 1906.

Messrs. J. and N. NADIN & CO.,

Burton-on-Trent.

Colliery—STANTON, ... Seam, ... Pit.
Shipping Port—King's Lynn.
Rail—Midland and L. and N. W., Swadlincote Station.
Canal— . . . . . .

H.P. Steam and Unscreened Cobbles.

Class of Coal—Steam.

The following is an analysis of the seam of coal from which the H.P. steam and unscreened cobbles are made:—

	Per cent.
Moisture	10·4
Volatile matter	28·1
Non-volatile matter or coke ..	61·5
(Sample as received) ..	100·0

Notes.

DERBYSHIRE.

H.P. Steam and Unscreened Cobbles—*cont.*

Analysis of dry coal—

	Per cent.
Carbon	70·0
Hydrogen	4·8
Sulphur	1·3
Ash (containing 0·2 per cent. salt)	8·8
Difference = oxygen and nitrogen	15·1
	100·00

Total thermal effect by Thomson's apparatus = 11·5 on dry coal.

Analysts—Matthews and Lott.

Date of Analysis—February 21, 1898.

THE SHEEPBRIDGE COAL AND IRON COMPANY LIMITED,

Chesterfield.

Colliery—LANGWITH, Glapwell and Norwood, Barnsley or Top Hard Seam.

Shipping Ports—Hull, Goole, Grimsby, Boston, Lynn, Liverpool, and Manchester.

Rail—{ Midland Railway, Glapwell, Norwood and Langwith Stations.
Great Central Railway, Langwith Station.

Canal— . . . . . .

Sheepbridge Best Steam Coal.

Class of Coal—Steam.

	Per cent.
Carbon	82·54
Hydrogen	6·19
Oxygen	7·80
Nitrogen	1·12
Sulphur	0·65
Ash	1·70
	100·00

14·74 lb. of water evaporated by 1 lb. of coal at 212 degs. Fahr.

Analyst—H. Thompson, F.C.S.

Date of Analysis—July 6, 1905.

DERBYSHIRE.

Notes.

Clapwell Gas Coal.

Class of Coal—Gas.

	Per cent.	Per cent.
Volatile matters—		
Gas, tar, &c.	34·21	
Sulphur	0·42	
Water at 212 degs. Fahr. ..	6·44	
		41·07
Coke—		
Fixed carbon	55·87	
Sulphur	0·42	
Ash	2·64	
		58·93
		100·00

Coke (dry) per ton of coal—11 cwts. 3 qrs. 4 lb.

Practical results—

Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	10,050 cubic feet
Illuminating power in standard sperm candles by union jet consuming 5 cubic feet per hour	16·0 candles
Value of 1 cubic foot of gas in sperm ..	384 grains
Equivalent of 1 ton of coal in sperm ..	551·3 lb.
Durability of 1 cubic foot of gas by 5 in. flame	43 minutes
Gravity of the gas (air = 1,000)	497 minutes

This coal yields about 10,000 cubic feet of 16 candle gas, and a coke of excellent quality.

Analyst—John Clark, Ph.D., F.C.S., F.I.C.
Date of Analysis—September 20, 1898.

Clapwell Cannel Coal.

Class of Coal—Gas.

	Per cent.	Per cent.
Volatile matters—		
Gas, tar, &c.	39·41	
Sulphur	0·35	
Water at 212 degs. Fahr. ..	2·66	
		42·42
Coke—		
Fixed carbon	38·24	
Sulphur	0·42	
Ash	18·92	
		57·58
		100·00

Coke (dry) per ton of coal—1,290 lb. or 11 cwts. 2 qrs. 2 lb.

Notes.

DERBYSHIRE.

Glapwell Cannel Coal—*cont.*

Practical results—

Gas per ton of coal at 60 degs. Fahr., and 30 in. bar.	10,230 cubic feet
Illuminating power, in standard sperm candles, by union jet consuming 5 cubic feet per hour at ·5 in. pressure	33·35 candles
Value of 1 cubic foot of gas in sperm ..	800 grains
Equivalent of a ton of coal in sperm ..	1,169 lb.
Durability of 1 cubic foot of gas by 5 in. flame	62 min. 36 sec.
Gravity of the gas (air = 1,000)	547

This coal gives upwards of 10,000 feet per ton of very rich gas, and is therefore valuable for enriching the gas made from coal of inferior quality. The coke is of inferior quality, but still suitable for firing gas retorts.

Analyst—William Wallace.

Date of Analysis—April 15, 1887.

SHEFFIELD COAL COMPANY LIMITED,

Corn Exchange Buildings, Sheffield.

Colliery—Birley, Silkstone Seam, South, East, West, and Beighton Pits.

Shipping Ports—Humber Ports, Partington, Liverpool, King's Lynn.

Rail—Great Central (Woodhouse Junction Station), and Midland (North Staveley Junction).

Canal—Nil.

Birley Silkstone Gas Coal.

Class of Coal—Gas.

Composition of coal as received—	Per cent.
Ash	1·79
Sulphur	0·94
Volatile matter	33·47
Fixed carbon	61·87
Moisture	1·93
	100·00

Yield of coal as received—	
Coke per ton	12·90 cwt.
Gas per ton	11,040 cubic feet
Illuminating power of gas about	19 standard candles

The above coal is essentially a gas coal, and is very rich in residuals.

Analyst—Alex. E. Tucker.

Date of Analysis—March 29, 1894.

Notes.

DERBYSHIRE.

Specific gravity	1·278
Weight of 1 cubic foot	79·9 lb.
Proximate analysis—	Per cent.
Moisture	2·26
Volatile products	31·37
Fixed carbon	62·72
Sulphur	1·13
Ash (reddish grey)	2·52
Commercial analysis—	
Gas per ton of coal	11,680 cubic feet
Gas per cubic foot of coal	417 cubic feet
Illuminating power of gas in standard sperm candles	16·92 candles
Sperm value of 1 cubic foot of the gas ..	406 grains
Sperm value of the gas per ton of coal ..	677 lb.
Coke per ton of coal	1,416 lb.
Coke per cent in the coal	63·2 per cent.
Ash in the coke	3·99 per cent.
Sulphur eliminated with the volatile products	12·6 lb.
Sulphur in the coke	12·6 lb.
Tar per ton of coal	15·2 gallons
Liquor per ton of coal	21·4 gallons

Analyst—R. O. Paterson.

Date of Analysis—May 3, 1897.

Colliery—ASTON (Barnsley Seam) Steam Coal, Aston Pit.

Aston (South Yorks.) Best Steam Hards.

Class of Coal—Steam.

Specific gravity	1·332
Moisture	3·78 per cent.
1 cubic foot weighs	83·0 lb.
Analysis of sample dried at 100 degs. Cent.—	Per cent.
Carbon	78·88
Hydrogen	4·42
Oxygen and hydrogen.. ..	11·68
Sulphur	0·79
Ash (very light)	4·23
	100·00

Notes.

Derbyshire.

Aston (South Yorks.) Best Steam Hards—*cont.*

Approximate analysis of other best South Yorkshire steam hards—

	Per cent.
Carbon	78 to 82
Hydrogen	4 to 5
Oxygen and nitrogen	8 to 12
Sulphur	0·50 to 1
Ash	4 to 6

Calorific value (calculated) in pounds of water which 1 lb. of coal will evaporate from 100 degs. Cent.—13·4 lb.

Analyst—C. K. Baker, F.I.C.
Date of Analysis—1903.

STANTON IRONWORKS COMPANY,

Teversall, Mansfield.

Colliery—Pleasley . . . . Seam, Pleasley Pit.
Shipping Ports—Hull, Grimsby, Partington, Lynn, Boston.
Rail—Midland, Great Northern, Great Central, L. and N. W., Pleasley Midland and Great Northern Stations.
Canal— . . . . . .

Pleasley Cannel Coal.

Class of Coal—Steam, Manufacturing, Gas.

A sample of this coal, representing the entire product of the seam, gave on examination the following results:—

The coal is black, possesses moderate lustre and moderate streak; fracture undulating to regular, with impressions of stigmaria, while cross-fracture is semi-conchoidal to angular, with deposits of ferric bisulphide and considerable deposits of calcium carbonate; moderately cohesive and compact; on the fire it does not intumesce; colour of ash, pinkish white; thickness of seam, 10 in.; mean specific gravity, 1,258 (water 1,000); weight of 1 cubic foot, 78·62 lb.

		Per cent.
Volatile matters (containing 0·42 of sulphur)		41·09
Coke, consisting of—		
Carbon	48·27	
Sulphur	0·16	
Ash	8·37	
		56·80
Water expelled at 212 degs. Fahr.		3·10
		100·99

Notes.

DERBYSHIRE.

Gaseous products—	
Gas per ton of coal, at 60 degs. Fahr. and 30 in. bar.	11,840 cubic feet
Gas from 1 cubic foot of the coal	415·56 cubic feet
Specific gravity of the gas	596 (air 1,000)
Hydrocarbons absorbed by bromine ..	12·25 per cent.
Durability of 1 cubic foot by 5 in. jet flame	58 min. 36 sec.
Value of 1 cubic foot of gas in sperm ..	699·84 grains
Value of gas from 1 ton of coal in sperm..	1,183·73 lb.
Illuminating power of gas in standard candles	29·16 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·20 per cent.
Carbonic acid (CO_2) in foul gas	3·00 per cent.
Carbonic oxide (CO) in foul gas	6·00 per cent.
Sulphur eliminated with volatile products	9·45 lb.
Liquid products—	
Tar per ton of coal	20·75 gallons
Ammoniacal liquor per ton of coal ..	12·75 gallons
Strength of ammoniacal liquor	2·75 degs. Twadd.
Hygrometric water per ton of coal ..	6·94 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	4·80 per cent.
Solid products—	
Coke per ton of coal	1,236·94 lb.
Carbon in the coke	86·80 per cent.
Ash in the coke	13·20 per cent.
Sulphur in the coke, per ton of coal ..	3·54 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)..	11·92 lb.

This coal parts with its volatile products speedily under a good heat, and yields a large volume of 29·16 candle gas. The coke, however, is of medium quality. The coal contains a very moderate amount of both water and sulphur. Compared with Main Lesmahagow cannel coal represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas) this coal is equal to 78·42

Analyst—Geo. R. Hislop.

Date of Analysis—November 2, 1894.

Notes.

DERBYSHIRE.

Pleasley Hard Coal.

Class of Coal—Steam, Manufacturing, House.

	As received.		Dried at 530 degs. Fahr.
Moisture	7·03	..	—
Ash	1·88	..	2·02
Sulphur	0·79	..	0·85
Hydrogen	4·81	..	5·17
Oxygen and hydrogen	8·83	..	9·50
Carbon	76·66	..	82·46
	100·00	..	100·00

Analyst—C. H. Bothomley.

Date of Analysis—May 18, 1889.

Notes.

DURHAM.

BEARPARK COAL AND COKE COMPANY LIMITED,

Middlesbrough.

Colliery—BEARPARK BRANCEPETH, Busty, Harvey, and Hutton Seams, ... Pit.

Shipping Ports—Tyne Dock (Sunderland and Hartlepools easy of access).

Rail—North Eastern, Witton Gilbert Station.

Canal— . . . .

Busty Seam.

Class of Coal—Steam, Gas and Coking.

	1st Analysis. Per cent.	2nd Analysis. Per cent.
Fixed carbon	68·44	68·28
Volatile hydrocarbons	26·85	27·00
Sulphur	0·77	0·77
Ash	3·10	3·10
Moisture	0·84	0·85
	100·00	100·00
Sulphur in ash	0·05	0·05
Yield of coke	71·95	

Analysis of coke produced—

	Per cent.
Carbon	95·13
Sulphur	0·57
Ash	4·30
	100·00

Examination for Gas—

On distilling the coal in a coal testing apparatus and examining the gas produced in a photometer, fitted with Sugg's No. 1 London Argand burner, the following results were obtained :—

Yield of gas per ton of coal . . . . . . 10,250 cubic feet.
Illuminating power in standard sperm candles . . . . 15·5 candles.

Analysts—Pattinson and Stead.

Date of Analysis—July 18, 1879.

Notes.

DURHAM.

Harvey Seam.

Class of Coal—Gas and Coking.

	Per cent.
Fixed carbon	65·75
Volatile hydrocarbons	27·40
Sulphur	1·67
Ash	4·08
Moisture	1·10
	100·00

Yield of coke	71·50 per cent.
Sulphur in ash	0·12 per cent.
Analysis of coke—	Per cent.
Carbon	92·58
Sulphur	1·72
Ash	5·70
	100·00
Yield of gas per ton of coal	10,192 cubic feet.
Illuminating power of gas	14·80 standard sperm [candles.
Light given by gas from one ton of coal when distilled, equal to	517·2 standard sperm [candles.
Yield of coke per ton of coal	14·30 cwt.

Analysts—Pattinson and Stead.

Date of Analysis—May 18, 1906.

Hutton Seam.

Class of Coal— . . . . . .

	Per cent.
Fixed carbon	70·13
Volatile hydrocarbons	23·94
Sulphur	0·78
Ash	4·45
Moisture	0·70
	100·00
Sulphur in ash	0·06
Yield of coke	75·0
Analysis of coke—	
Carbon	93·51
Sulphur	0·56
Ash	5·93
	100·00

Notes.

DURHAM.

Yield of gas per ton of coal	10,438 cubic feet.
Illuminating power of gas	16·5 standard candles.
Weight of standard sperm candles which will give the same light as the gas from one ton of coal	590·5 lb.

Analysts—Pattinson and Stead.
Date of Analysis—June 25, 1890.

BELL BROTHERS LIMITED,

Middlesbrough.

Colliery—BROWNEY, Hutton Seam, ... Pit.
Shipping Ports—West Hartlepool and Tyne Dock.
Rail—North Eastern, Ferryhill Station.
Canal— . . . .

Browney Nuts.

Class of Coal—Gas, Steam, Manufacturing.

	Per cent.
Moisture	2·20
Ash	9·38
Sulphur	1·69
Volatile matter	30·90
Fixed carbon	55·83
	100·00

Analyst—Weldon Hanson.
Date of Analysis—March, 1905.

Colliery—TURSDALE, Busty Seam, ... Pit.

Tursdale Screened Coal.

Class of Coal—Steam, Manufacturing.

	Per cent.
Moisture	1·52
Ash	7·60
Sulphur	1·12
Volatile matter	29·80
Fixed carbon	59·96
	100·00

Analyst—Weldon Hanson.
Date of Analysis—December, 1905.

Notes.

DURHAM.

JOHN BOWES & PARTNERS LIMITED,

Milburn House, Newcastle-on-Tyne.

Colliery—FELLING, Beaumont, &c., Seams, Felling Pit.

Shipping Port—Felling-on-Tyne.

Rail—North Eastern, Felling Station.

Canal— . . . .

Tyne Main Coals.

Class of Coal—Gas.

On distilling the coal in a coal-testing apparatus the results were:—

Illuminating gas (per ton)	10,500 cubic feet.
Illuminating power of gas expressed in standard sperm candles	18·16 candles.
Sperm value (per ton)	653·76 lb.

The coke assay was—

	Per cent.
Coke	71·3
Volatile matters	28·7
	100·00

The coke was of good quality.

A partial analysis of the coal was made, and the following results obtained:—

	Per cent.
Fixed carbon	63·73
Ash	7·57
Sulphur	1·23
Moisture	1·04

Analyst—W. H. Blake.

Date of Analysis— . . . .

Felling Main Gas Coal.

Class of Coal—Gas.

On submitting the coal to distillation in a coal-testing apparatus 10,500 cubic feet of gas were obtained, having an illuminating power equal to 17·3 standard sperm candles as ascertained by burning the gas at the rate of 5 cubic feet per hour in a photometer fitted with the No. 1 London Argand standard burner. The coal yielded the following percentage amounts of coke and volatile matters:—

	Per cent.
Coke	68·0
Volatile matters	32·0
	100·00

The resulting coke was of good quality.

DURHAM.

Notes.

A complete "ultimate" analysis of the coal was made, and the following results were obtained:—

	Per cent.
Carbon	80·30
Hydrogen	4·87
Oxygen	7·17
Nitrogen	1·50
Sulphur	1·30
Ash	3·76
Water	1·10
	100·00

Analyst—John Pattinson.

Date of Analysis— . . . .

Colliery—SPRINGWELL, High Main and Maudlin Seams, Springwell Pit.

Shipping Port—Jarrow-on-Tyne.

Rail—North Eastern, Jarrow Station.

Canal— . . . .

Peareth Gas Coals.

Class of Coal—Gas.

On submitting the coal to distillation in a coal-testing apparatus 10,500 cubic feet of gas were obtained per ton of coal, having an illuminating power equal to 15·3 standard sperm candles as ascertained by burning the gas at the rate of 5 cubic feet per hour in a photometer fitted with the No. 1 London Argand standard burner. The coal yielded the following percentage amounts of coke and volatile matters:—

	Per cent.
Coke	69·2
Volatile matters	30·8
	100·0

A complete "ultimate" analysis of the coal was made, and the following results were obtained:—

	Per cent.
Carbon	82·04
Hydrogen	4·96
Oxygen	5·36
Nitrogen	1·74
Sulphur	1·10
Ash	3·36
Water	1·44
	100·00

Analysts—J. and H. S. Pattinson.

Date of Analysis—April 13, 1901.

Notes.

DURHAM.

Ravensworth Pelaw Gas Coal.

Class of Coal—Gas.

On submitting the coal to distillation in a coal-testing apparatus 10,500 cubic feet of gas were obtained per ton of coal, having an illuminating power equal to 15·1 standard sperm candles as ascertained by burning the gas at the rate of 5 cubic feet per hour in a photometer fitted with the No. 1 London Argand standard burner. The coke yielded the following percentage amounts of coke and volatile matters :—

	Per cent.
Coke..	69·5
Volatile matters	30·5
	100·0

A complete "ultimate" analysis of the coal was made, and the following results were obtained :—

	Per cent.
Carbon	84·16
Hydrogen	5·00
Oxygen	4·18
Nitrogen	1·66
Sulphur	1·13
Ash	2·70
Water	1·17
	100·00

Analysts—J. and H. S. Pattinson.

Date of Analysis—April 13, 1901.

CARTERTHORNE COLLIERY COMPANY LIMITED,

Zetland Buildings, Middlesbrough.

Colliery—CARTERTHORNE, Main Seam, ... Pit.

Shipping Ports—Tyne Dock, West Hartlepool, Middlesbrough.

Rail—North Eastern, Evenwood Station.

Canal— . . . .

Carterthorne Gas Coal.

Class of Coal—Gas.

	Per cent.
Carbon	67·17
Volatile hydrocarbons	27·73
Sulphur	1·05
Ash	2·25
Water	1·80
	100·00
Yield of coke	69·95

Analysts—Pattinson and Stead.

Date of Analysis— . . . .

DURHAM.

Notes.

CONSETT IRON COMPANY LIMITED,

Blackhill, Co. Durham.

Colliery— , ... Brockwell, Three-quarter and Five-quarter Seams, ... Pit.

Shipping Ports—Dunston Staiths, Tyne Dock and Sunderland.

Rail— . . . . Station.

Canal— . . . .

Original Caresfield Gas Coal.

Class of Coal—Gas.

Yield of gas per ton of coal ..	10,500 cubic feet
Illuminating power	16·1 candles
Coke	71·3 per cent.
Volatile matters	28·7 per cent.
Ultimate analysis—	Per cent.
Carbon	82·88
Hydrogen	4·68
Oxygen	6·18
Nitrogen	1·24
Sulphur	0·61
Ash	3·36
Water	1·05

The coal giving this analysis was made up of 80 per cent. from the Brockwell seam, 12 per cent. from Three-quarter seam, and 8 per cent. from the Five-quarter seam.

Analyst— . . . .

Date of Analysis— . . . .

EAST PONTOP COAL COMPANY LIMITED,

Annfield Plain, R.S.O.

Colliery— . . . . Seam, ... Pit.

Shipping Ports—Tyne Dock, Sunderland.

Rail— . . . . Station.

Canal— . . . .

East Pontop Gas Coals.

Class of Coal—Gas.

Yield of gas per ton of coal ..	10,500 cubic feet.
Illuminating power	17·8 standard sperm [candles
Coke	69·7 per cent.
Volatile matters	30·3 per cent.

Notes.

DURHAM.

East Pontop Gas Coals—*cont.*

Ultimate analysis—	Per cent.
Carbon	84·49
Hydrogen	5·16
Oxygen	3·94
Nitrogen	1·62
Sulphur	1·26
Ash	2·30
Water	1·23

Analyst—. . . . . .

Date of Analysis— . . . .

East Castle Small Coal.

Class of Coal— . . . .

	Per cent.
Carbon	65·19
Volatile matters	27·98
Ash	6·83

Analyst— . . . .

Date of Analysis— . . . .

FERENS & LOVE,

Durham.

Colliery—CORNSAY, ... Seam, ... Pit.

Shipping Ports—Tyne Dock and Sunderland.

Rail—North Eastern, Waterhouses Station.

Canal— . . . .

West Brancepeth Unscreened Coking Coal.

Class of Coal—Coking.

	Per cent.
Fixed carbon	72·0
Volatile matters	21·4
Ash	6·6
Sulphur	1·23
Coke..	78·6
Moisture	1·2
Phosphorus in ash	0·0066
Ash..	Grey.

Analyst—W. H. Blake.

Date of Analysis—February 6, 1904.

Notes.

DURHAM.

West Brancepeth Gas Coal.

Class of Coal—Gas.

Yield of gas per ton of coal ..	10,108 cubic feet.
Illuminating power	17·75 standard sperm candles.
Coke	73·90 per cent.
Volatile matters	26·10 per cent.
Ultimate analysis—	Per cent.
Carbon	84·40
Hydrogen	5·18
Oxygen	4·74
Nitrogen	1·28
Sulphur	0·82
Ash	2·15
Water	1·43

Analyst—W. F. Keating Stock.

Date of Analysis—March 14, 1895.

HAMSTERLEY COLLIERY LIMITED,

Milburn House, Newcastle-on-Tyne.

Colliery—HAMSTERLEY, ... Seam . . . . Pit.
Shipping Ports—Dunston and Tyne Dock.
Rail—North Eastern Railway, Ebchester Station.
Canal— . . . . . .

Hamsterley Coking Coal.

Class of Coal—Coking.

Sampled from wagons during shipment at Dunston Staiths, January 24, 1906.

	Per cent.
Fixed carbon	71·57
Volatile matters	25·50
Ash	2·93
Sulphur	0·71
Coke	74·50
Moisture	0·58
Ash	Light Red.

Analyst—W. H. Blake, F.C.S.

Date of Analysis—July 10, 1906.

Notes.

DURHAM.

HARTON COAL COMPANY LIMITED,

South Shields.

Colliery—BOLDON, ... Seam, ... Pit.
Shipping Ports—Tyne Dock and private shipping places on River Tyne, and at Sunderland.
Rail—North Eastern, Brockley Whins Station.
Canal— . . . . . .

Boldon Gas Coal.

Class of Coal—Gas.

Yield of gas per ton of coal..	10,500 cubic feet.
Illuminating power	16·9 candles.
Coke	66·7 per cent.
Volatile matters	33·3 per cent.
	Per cent.
Carbon	82·36
Hydrogen	5·11
Oxygen	6·56
Nitrogen	1·05
Sulphur	0·86
Ash	2·04
Moisture	2·02

This coal (Boldon) is of repute as an excellent gas coal. It is sent freely to London and the east and the south coasts, and is a favourite coal with German, French, Italian and other gasworks.

Analyst—John Pattinson, F.I.C., F.C.S.
Date of Analysis— . . . . . .

THOS. HEDLEY & BROS.,

Maritime Buildings, Newcastle-on-Tyne.

Colliery—HOLMSIDE, Main Coal and Hutton Seams, Various Pits.
Shipping Ports—Tyne Dock (Tyne), and South Dock (Sunderland).
Rail—North Eastern, Craghead Station.
Canal— . . . . . .

Holmside Gas Coal.

Class of Coal—Gas.

Yield of gas per ton of coal..	10,500 cubic feet.
Illuminating power	17 standard sperm candles.
Coke	67·8 per cent.
Volatile matters	32·2 per cent.

Notes.

DURHAM.

	Per cent.
Carbon	82·04
Hydrogen	5·00
Oxygen	5·38
Nitrogen	1·36
Sulphur	1·52
Ash	3·36
Water	1·34

Analysts—J. and H. S. Pattinson.
Date of Analysis—February 21, 1902.

HETTON COAL COMPANY,

Hetton-le-Hole.

Colliery— . . . . Seam, ... Pit.
Shipping Port—Sunderland.
Rail—North Eastern, Hetton Station.
Canal— . . . . . .

Hetton Steam Coals.

Class of Coal—Steam.

	Per cent.
Carbon	81·11
Hydrogen	5·37
Oxygen .. .. } Nitrogen .. .. }	7·74
Ash	2·80
Sulphur	0·90
Moisture	2·08

Calorific value of coal in Centigrade heat units (being pounds of water capable of being heated 0 to 1 deg. Cent. by 1 lb. of coal)=6,530.

Water evaporated from 212 degs. Fahr. by 1 lb. of the coal=13·5 lb.

Analyst— . . . . . .
Date of Analysis— . . . . . .

Notes.

DURHAM.

Hetton Gas Coal.

Class of Coal—Gas.

Yield of gas per ton of coal	10,500 cubic feet.
Illuminating power	16·4 standard sperm candles.
Coke	65·2 per cent.
Volatile matters	34·8 per cent.
Complete ultimate analysis—	Per cent.
Carbon	77·07
Oxygen	11·85
Hydrogen	4·04
Nitrogen	1·04
Sulphur	1·28
Ash	2·44
Water	2·28

Analyst—John Pattinson, F.I.C., F.C.S.

Date of Analysis—1887.

HEWORTH COAL COMPANY LIMITED,

Watergate Buildings, Newcastle-on-Tyne.

Colliery—HEWORTH, Various Seams, John and Ada Pits.
Shipping Port—Private Staiths on River Tyne.
Rail— . . . . Station.
Canal— . . . .

Dean's Primrose Gas Coal.

Class of Coal—Gas.

Yield of gas per ton of coal	11,500 cubic feet.
Illuminating power	16·5 standard sperm candles.
Illuminating power expressed in sperm ..	650·6 lb.
Coke	67·3 per cent.
Volatile matters	32·7 per cent.
Ultimate analysis -	Per cent.
Carbon	81·82
Hydrogen	4·82
Oxygen	6·38
Nitrogen	1·64
Sulphur	0·87
Ash	2·84
Water	1·63
	100·00

Analysts—J. and H. S. Pattinson.

Date of Analysis—March 9, 1900.

Notes.

DURHAM.

HORDEN COLLIERIES LIMITED,

Crown Street Chambers, Darlington.

Colliery—HORDEN, Low Main Seam, ... Pit.
Shipping Ports—East and West Hartlepool, Seaham, South Dock, Tees, and Tyne.
Rail—North Eastern, ... Station.
Canal— . . . .

Horden Low Main Screened Coal.

Class of Coal—Steam.

I hereby certify that I have analysed the undermentioned sample of Horden Low Main screened coal received from the Horden Collieries Limited, December 21, and that I find as follows:—

	Per cent.
Fixed carbon	59·15
Volatile hydrocarbons .. .	34 68
Ash	3·80
Sulphur	0·87
Moisture	1·50
	100·00

The absolute heating power of the sample when burnt under standard conditions in a Thompson's calorimeter is equal to the evaporation of 14·63 lb. of water from 212 degs. Fahr.

An examination of the ash shows that it is not liable to clinker with proper firing.

Analyst—W. F. Keating Stock.
Date of Analysis—December 23, 1905.

Colliery—HORDEN, No. 2 Seam, ... Pit.

No. 2 Seam Gas Coal.

Class of Coal—Gas.

	Per cent.
Fixed carbon	49·80
Volatile hydrocarbons . ..	44·30
Ash	2·48
Sulphur	1·69
Moisture	1·73
	100·00
Yield of coke (absolute)	53·25
Ash in coke	4·65
Yield of purified gas per ton at standard temperature and pressure	12,879 cubic feet.
Illuminating power	21¼ standard sperm candles.

Analyst—W. F. Keating Stock.
Date of Analysis—January 21, 1904.

Notes.

DURHAM.

Horden Hutton Seam.

Class of Coal—Gas.

Yield of gas per ton of coal..	11,415 cubic feet.
Illuminating power of the gas	$16\frac{3}{4}$ standard sperm candles.

These results were obtained on submitting the coal to distillation in a coal-testing apparatus and burning the gas so obtained at the rate of 5 cubic feet per hour in a photometer fitted with a No. 1 London standard Argand burner.

A chemical analysis of the coal gave as follows:—

	Per cent.
Fixed carbon	58·09
Volatile hydrocarbons	31·74
Ash	6·67
Sulphur	3·04
Moisture	0·46
	100·00
Absolute yield of coke	66·50
Ash in coke	10·03

The sperm equivalent of this sample is 655 lb.

Analyst—W. F. Keating Stock.
Date of Analysis– August 6, 1904.

Colliery—HORDEN, Hutton Seam, ... Pit.

Horden Hutton Seam Coal (Working Test).

Class of Coal—Gas and Coking.

Specific gravity of coal (water as 1) ..	1·278
Weight of one cubic foot	79·87 lb.
Ash in the coal	4·2 per cent.
Sulphur in coal	1·56 per cent.
Purified gas per ton of coal..	10,712 cubic feet.
Purified gas per cubic foot of coal ..	381·9 cubic feet.
Illuminating power	16·95 candles.
Value of gas from 1 ton of coal	622·5 lb. sperm.
Value of 1 cubic foot of gas	406·8 grains sperm.
Weight of coke per ton of coal	1,496 lb.
Coke per ton of coal	66·78 per cent.
Tar per ton of coal obtained to outlet of condensers	10·25 gallons.
Ammoniacal liquor per ton of coal obtained to outlet of condensers	16·5 gallons
Strength of ammoniacal liquor, degrees Twaddell	5·5 degs.

Analyst—Matt. Dunn, M.Inst.Mech.E.
Date of Analysis—June 20, 1905.

Notes.

DURHAM.

Colliery—HORDEN, Main Seam, ... Pit.

Horden Main Seam Coal.

Class of Coal—Coking and Gas.

	Per cent.
Fixed carbon	59·40
Volatile hydrocarbons . .	33·66
Ash	4·20
Sulphur	1·22
Moisture	1·52
	100·00
Yield of coke (absolute)	64·30
Ash in coke	6·53
Sulphur in coke	1·08
Yield of purified gas per ton at standard temperature and pressure	12,373 cubic feet.
Illuminating power in standard sperm candles	15·25

Analyst—W. F. K. Stock.

Date of Analysis—February 10, 1904.

Colliery—SHOTTON, Hutton Seam, ... Pit.

Shotton Hutton Seam Coal.

Class of Coal—Coking.

	Per cent.
Fixed carbon	66·79
Volatile hydrocarbons	24·20
Ash	5·65
Sulphur	2·14
Moisture	1·22
	100·00
Yield of coke (absolute)	73·95
Ash in coke	7·62
Yield of purified gas per ton at standard temperature and pressure	9,760 cubic feet.
Illuminating power in standard sperm candles	17·3

Analyst—W. F. K. Stock.

Date of Analysis—December 18, 1903.

Notes.

DURHAM.

Colliery—SHOTTON, Five-Quarter Seam, ... Pit.

Shotton Five-Quarter Seam Coal.

Class of Coal—Gas, Steam, Manufacturing and Coking.

	Per cent.
Fixed carbon	69·30
Volatile hydrocarbons	23·09
Ash	4·55
Sulphur	2·18
Moisture	0·88
	100·00
Yield of coke	75·40
Ash in coke	6·03
Sulphur in coke	1·92
Yield of gas per ton of coal	10,416 cubic feet.
Illuminating power	14·50 standard sperm candles.
Light given by gas from 1 ton of coal when distilled	517·8 standard sperm candles.
Water capable of being evaporated by 1 lb. of coal	14·06 lb.

Analysts—Pattinson and Stead.

Date of Analysis—August 16, 1901.

LAMBTON COLLIERIES LIMITED,

Cathedral Buildings, Newcastle-on-Tyne.

Colliery— . . . . Seam, ... Pit.

Shipping Ports—Lambton Staiths and Tyne Dock.

Rail— . . . . Station.

Canal— . . . . . .

Lambton Gas Coal.

Class of Coal—Gas.

Yield of gas per ton	11,000 cubic feet.
Illuminating power	14·9 standard candles.
Sperm value per ton	562 lb.
Yield of coke	68·0 per cent. = 13·6 cwt. per ton.
Proximate analysis—	Per cent.
Moisture	1·50
Ash	7·57
Volatile hydrocarbons	28·94
Fixed carbon	60·43
Sulphur	1·56
	100·00

Analyst—G. P. Lishman, D.Sc., F.I.C.

Date of Analysis—March, 1906.

Notes.

DURHAM.

Colliery— . . . . Seam, ... Pit.

New Leverson's Gas Coal.

Class of Coal—Gas.

	Per cent.
Moisture	1·44
Ash	5·81
Volatile hydrocarbons	30·64
Fixed carbon	60·66
Sulphur	1·45
	100·00

Yield of gas per ton	11,000 cubic feet.
Illuminating power	15·2 candles.
Sperm value per ton	573 lb.
Yield of coke	66·5 per cent.

Analyst—G. P. Lishman, D.Sc., F.I.C.

Date of Analysis—1906.

Colliery . . . . Seam, ... Pit.

Lambton Washed Nuts.

Class of Coal— . . . .

Proximate analysis (air dried)—	Per cent.
Moisture	1·54
Ash	4·58
Volatile hydrocarbons	32·05
Fixed carbon	60·39
Sulphur	1·44
	100·00

Heating value—

1 lb. coal raises 13,306 lb. water 1 deg. Fahr.=B.T.U.
1 lb. coal raises 73·9 ,, from 32 degs. to 212 degs. Fahr.
1 lb. coal raises 88·7 ,, ,, 62 degs. to 212 degs. Fahr.
1 lb. coal raises 11·91 ,, ,, 62 degs. to steam at 212 degs. Fahr.
1 lb. coal raises 13·76 ,, ,, 212 degs. to steam at 212 degs. Fahr. = evaporative power.
1 lb. coal raises 7,388 ,, 1 deg. Cent. = calorific value.

Analyst—G. P. Lishman, D.Sc., F.I.C.

Date of Analysis—March, 1906.

Notes.

DURHAM.

Colliery . . . . Seam, ... Pit.

Lambton Washed Duff.

Class of Coal— . . . .

Proximate analysis (air-dried)—	Per cent.
Moisture	1·71
Ash	5·33
Volatile hydrocarbons	30·56
Fixed carbon	60·75
Sulphur	1·65
	100·00

Heating value—

1 lb. coal raises 12,639 lb. water 1 deg. Fahr. = B.T.U.
1 lb. coal raises 70·2 ,, from 32 degs. to 212 degs. Fahr.
1 lb. coal raises 84·2 ,, ,, 62 degs. to 212 degs. Fahr.
1 lb. coal raises 11·31 ,, ,, 62 degs. to steam at 212 degs. Fahr.
1 lb. coal raises 13·07 ,, ,, 212 degs. to steam at 212 degs. Fahr. = evaporative power.
1 lb. coal raises 7,020 ,, 1 deg. Cent. = calorific value.

Analyst—G. P. Lishman, D.Sc., F.I.C.
Date of Analysis—March, 1906.

Colliery— . . . . Seam, ... Pit.

Lambton Washed Peas.

Class of Coal . . . .

Proximate analysis (air-dried)—	Per cent.
Moisture	1·52
Ash	4·41
Volatile hydrocarbons	31·14
Fixed carbon	61·47
Sulphur	1·46
	100·00

1 lb. coal raises 13,340 lb. water 1 deg. Fahr = B.T.U.
1 lb. coal raises 74·1 ,, from 32 degs. to 212 degs. Fahr.
1 lb. coal raises 88·9 ,, ,, 62 degs. to 212 degs. Fahr.
1 lb. coal raises 11·94 ,, ,, 62 degs. to steam at 212 degs. Fahr.
1 lb. coal raises 13·79 ,, ,, 212 degs. to steam at 212 degs. Fahr. = evaporative power.
1 lb. coal raises 7,407 ,, 1 deg. Cent. = calorific value.

Analyst—G. P. Lishman, D.Sc., F.I.C.
Date of Analysis—March, 1906.

Notes.

DURHAM.

Colliery— . . . . Seam, ... Pit.

Lambton Steam Coal.

Class of Coal—Steam.

	Per cent.
Carbon	81·00
Hydrogen	5·09
Oxygen	5·48
Nitrogen	1·62
Sulphur	1·14
Ash	4·12
Water	1·55
	100·00

Heating value—

1 lb. coal raises 13,247 lb. water 1 deg. Fahr.=B.T.U.
1 lb. coal raises 73·6 ,, from 32 degs. to 212 degs. Fahr.
1 lb. coal raises 88·3 ,, ,, 62 degs. to 212 degs. Fahr.
1 lb. coal raises 11·85 ,, ,, 62 degs. to steam at 212 degs. Fahr.
1 lb. coal raises 13·70 ,, ,, 212 degs. to steam at 212 degs. Fahr. =evaporative power.

1 lb. coal raises 7,349 ,, 1 deg. Cent.=calorific value.

Analyst—G. P. Lishman, D.Sc., F.I C.
Date of Analysis—March, 1906.

Colliery— . . . . Seam, ... Pit.

Lambton Duff.

Class of Coal— . . . .

Proximate analysis—	Per cent.
Moisture	1·68
Ash	15·30
Volatile hydrocarbons	23·87
Fixed carbon	57·29
Sulphur	1·86
	100·00

Heating value—

1 lb. coal raises 10,939 lb. water from 32 degs. to 33 degs. Fahr.=B.T.U.
1 lb. coal raises 60·7 ,, ,, 32 degs. to 212 degs. Fahr.
1 lb. coal raises 72·9 ,, ,, 62 degs. to 212 degs. Fahr.
1 lb. coal raises 9·79 ,, ,, 62 degs. to steam at 212 degs. Fahr.
1 lb. coal raises 11·28 ,, ,, 212 degs. to steam at 212 degs. Fahr.
1 lb. coal raises 6,011 ,, 1 deg. Cent.=calorific value.

Analyst—G. P. Lishman, D.Sc., F.I.C.
Date of Analysis—March, 1906.

Notes.

DURHAM.

Colliery— . . . . Seam, ... Pit.

Lambton Rough Small.

Class of Coal— . . . . . .

Proximate analysis—	Per cent.
Moisture	1·52
Ash	11·75
Volatile matters	27·11
Fixed carbon	57·85
Sulphur	1·77
	100·00

1 lb. coal raises 11,797 lb. water 1 deg. Fahr.=B.T.U.
1 lb. coal raises 65·5 ,, f om 32 degs. to 212 degs. Fahr.
1 lb. coal raises 78·6 ,, ,, 62 degs. to 212 degs. Fahr.
1 lb. coal raises 10·56 ,, ,, 62 degs. to steam at 212 degs. Fahr.
1 lb. coal raises 12·2 ,, ,, 212 degs. to steam at 212 degs. Fahr.
1 lb. coal raises 6,553 ,, 1 deg. Cent.=calorific value.

Analyst—G. P. Lishman, D.Sc., F.I.C.
Date of Analysis—March, 1906.

Colliery— . . . . Seam, ... Pit.

Sherburn Unwashed Coals.

Class of Coal— . . . . . .

	Rough Small.	Peas and Duff.
Moisture	1·61	1·67
Ash	12·06	16·65
Volatile hydrocarbons ..	31·20	29·73
Fixed carbon	53·15	50·25
Sulphur	1·98	1·70
	100·00	100·00

	Rough Small. Lb.	Peas and Duff. Lb.
Water raised 1 deg. Fahr by 1 lb. coal	12,260	11,101
Water raised from 32 degs. to 212 degs. Fahr. by 1 lb. coal	68·1	61·6
Water raised ,, 62 degs. to 212 degs. Fahr. by 1 lb. coal	81·7	74·0
Water raised ,, 62 degs. to steam at 212 F. by 1 lb. coal	10·97	9·93
Water raised ,, 212 degs. to steam at 212 F. by 1 lb. coal	12·67	11·48
Water raised 1 deg. Cent. by 1 lb. coal	6,807	6,169

Analyst—G. P. Lishman, D.Sc., F.I.C.
Date of Analysis—March 1906.

DURHAM.

Notes.

Colliery— . . . . Seam, ... Pit.

Air-dried Sherburn Washed Coals.

Class of Coal— . . . .

	Nuts. Per cent.	Peas. Per cent.	Duff. Per cent.
Moisture	1·55	1·44	1·60
Ash	3·90	3·52	7·12
Volatile combustible matter..	33·89	34·67	30·05
Fixed carbon	59·15	58·88	59·10
Sulphur..	1·51	1·49	2·13
	100·00	100·00	100 00

	Nuts. Lb.	Peas. Lb.	Duff. Lb.
Water raised 1 deg. Fahr by 1 lb. coal=B.T.U. ..	13,410	13,350	12,090
Water raised from 32 degs. to 212 degs. F. by 1 lb. coal	74·5	74·1	67·1
Water raised „ 62 degs. to 212 degs. F. by 1 lb. coal	89·4	89·0	80·3
Water raised „ 62 degs. to steam at 212 F. by 1 lb. coal	12·03	11·95	10·82
Water raised „ 212 degs. to steam at 212 F. by 1 lb. coal	13·86	13·80	12·50
Water raised 1 deg. Cent. by 1 lb. coal.. ..	7,446	7,415	6,701

Analyst—G. P. Lishman, D.Sc., F.I.C.
Date of Analysis—March, 1906.

Colliery— . . . . Seam, ... Pit.

Lambton Treble Nuts.

Class of Coal— . . . .

	Per cent.
Moisture	1·50
Ash	4·23
Volatile hydrocarbons	33·31
Fixed carbon	59·40
Sulphur	1·56
	100·00

Water raised 1 deg. Fahr. by 1 lb. coal=B.T.U. ..	13,209 lb.
Water raised from 32 degs. to 212 degs. Fahr. by 1 lb. coal	73·3 lb.
Water raised „ 62 degs. to 212 degs. Fahr. by 1 lb. coal	88·0 lb.
Water raised „ 62 degs. to steam at 212 F. by 1 lb. coal	11·82 lb.
Water raised „ 212 degs. to steam at 212 F. by 1 lb. coal	13 66 lb.
Water raised 1 deg. Cent. by 1 lb. coal	7,335 lb.

Analyst—G. P. Lishman, D.Sc., F.I.C.
Date of Analysis—1906.

Notes.

DURHAM.

Colliery— . . . . Seam, ... Pit.

Lambton Wallsend and Finchale Wallsend.

Class of Coal— . . . .

	Wallsend. Per cent.		Finchale Wallsend. Per cent.
Carbon	80·06	..	80·41
Hydrogen	5·21	..	5·11
Nitrogen	1·55	..	1·41
Oxygen	6·17	..	6·00
Moisture..	1·66	..	1·47
Sulphur	1·45	..	1·38
Ash	3·90	..	4·22
	100·00	..	100·00

Analyst—G. P. Lishman, D.Sc., F.I.C.
Date of Analysis—1906.

Colliery— . . . . Seam, ... Pit.
Shipping Port—Sunderland.

Sherburn Gas Coal.

Class of Coal—Gas.

Yield of gas per ton	11,000 cubic feet.
Illuminating power	14·5 sperm candles.
Value of 1 ton of coal in pounds sperm ..	547 lb.
Coke	69·8 per cent. = 13·9 cwt. per ton.

Proximate analysis—	Per cent.
Moisture	1·35
Ash	8·21
Volatile hydrocarbons	27·19
Fixed carbon	61·59
Sulphur	1·66
	100·00

Analyst—G. P. Lishman, D.Sc., F.I.C.
Date of Analysis—February 28, 1906.

Notes.

DURHAM.

LONDONDERRY COLLIERIES LIMITED,

Seaham Harbour.

Colliery—SEAHAM, Hutton and Maudlin Seams, Nos. 1, 2 and 3 Pits.
Shipping Ports—Seaham, per Dock Company's and own line; Sunderland, per North Eastern Railway.
Rail— . . . . Station.
Canal— . . . .

Londonderry Gas Coal.

Class of Coal—Gas.

On submitting the coal to distillation in a coal-testing apparatus 11,000 cubic feet of gas were obtained per ton of coal, having an illuminating power equal to 17·2 standard sperm candles as ascertained by burning the gas at the rate of 5 cubic feet per hour in a photometer fitted with the No. 1 London Argand standard burner. The illuminating value of the coal per ton expressed in terms of sperm is 649 lb. The coal yielded the following percentage amounts of coke and volatile matters:—

	Per cent.
Non-volatile matters (coke)	65·3
Volatile matters, including water, expelled at a red heat in a closed vessel	34·7
	100·00

A complete "ultimate" analysis of the coal was made, and the following results were obtained:—

	Per cent.
Carbon	81·49
Hydrogen	5·25
Oxygen	6·22
Nitrogen	1·65
Sulphur	1·32
Ash	2·18
Water	1·89
	100·00

Analysts—J. and H. S. Pattinson.
Date of Analysis—April 30, 1903.

Notes.

DURHAM.

LOW BEECHBURN COAL COMPANY LIMITED,

Crook, R.S.O., Co. Durham.

Colliery—LOW BEECHBURN, Durham Hutton Seam, Low Beechburn Pit.

Shipping Ports—Sunderland, Tyne Dock and Middlesbrough.

Rail— . . . . Station.

Canal— . . . . . .

Low Beechburn Unscreened Steam Coal.

Class of Coal—Steam.

	Per cent.
Fixed carbon	67·92
Volatile hydrocarbons	29·53
Ash	1·60
Sulphur	0·95

Analyst— . . . . . .

Date of Analysis—July, 1905.

Colliery—LOW BEECHBURN, Harvey Seam, Low Beechburn Pit.

Low Beechburn Gas Coal.

Class of Coal—Gas.

	Per cent.
Fixed carbon	66·97
Volatile hydrocarbons	27·87
Sulphur	1·15
Ash	2·55
Moisture	1·46
	100·00
Sulphur in ash	Trace
Yield of coke	70·31 per cent.
Yield of gas per ton of coal..	9,632 cubic feet.
Illuminating power of gas produced ..	17·63 candles.
Light given by gas from 1 ton of coal when distilled, equal to that from sperm	582·21 lb.
Analysis of coke—	Per cent.
Carbon	95·07
Sulphur	1·13
Ash	3·80
	100·00

Analysts—Pattinson and Stead.

Date of Analysis—March 3, 1899.

DURHAM.

Notes.

NORTH BITCHBURN COAL COMPANY LIMITED,

Darlington.

Colliery— . . . . Seam, Randolph Pit.
Shipping Ports—Middlesbrough, West Hartlepool, Tyne Dock.
Rail—North Eastern, Evenwood Station.
Canal— . . . .

Randolph Washed Single Nuts.

Class of Coal—Gas.

	Per cent.
Fixed carbon	62·32
Volatile hydrocarbons	31·32
Sulphur	0·41
Ash	4·35
Moisture	1·60
	100·00
Sulphur in ash	0·25
Yield of coke	67·00
Analysis of coke—	
Carbon	92·99
Sulphur	0·51
Ash	6·50
	100·00
Yield of gas per ton of coal	10,800 cubic feet.
Illuminating power of gas	18·1 candles

Light given by gas from 1 ton of coal when distilled, equal to 670 2 lb. standard sperm candles.

Analysts—Pattinson and Stead.

Date of Analysis—July 12, 1894.

Wallsend Gas Coal.

Class of Coal—Gas.

	Per cent.
Fixed carbon	60·95
Volatile hydrocarbons	32·16
Ash	3·12
Sulphur	0·66
Moisture	3·11
	100·00

Notes.

DURHAM.

Wallsend Gas Coal—*cont.*

Yield of gas per ton in cubic feet at standard temperature and pressure	9,949 cubic feet
Illuminating power in standard sperm candles	16·63 candles
Yield of dry coke per ton	1,443·68 lb.
Ash in the coke	4·84 per cent.
Sulphur in coke	0·57 lb.

Analyst—W. F. Keating Stock.

Date of Analysis—February 6, 1899.

NORTH BRANCEPETH COAL COMPANY LIMITED,

Darlington.

Colliery— . . . . Hutton Seam, ... Pit.

Shipping Ports—Sunderland, Hartlepool, and Tyne Dock.

Rail— . . . . Station.

Canal— . . . .

North Brancepeth Gas Coal.

Class of Coal—Gas.

Yield of gas per ton of coal..	10,752 cubic feet
Illuminating power	16·60 standard sperm candles
Value of 1 ton of coal in pounds sperm ..	611·9 lb.

Analysts—Pattinson and Stead.

Date of Analysis—September 27, 1892.

Colliery— . . . . Busty Seam, ... Pit.

Littleburn (Busty Seam) Coal.

Class of Coal—Gas.

	Per cent.
Fixed carbon	65·33
Volatile hydrocarbons	27·73
Ash	5·30
Sulphur	0·78
Moisture	0·86

Analysts—Pattinson and Stead.

Date of Analysis—October 4, 1892.

DURHAM

Notes.

PRIESTMAN COLLIERIES LIMITED,

Milburn House, Newcastle-on-Tyne.

Colliery—AXWELL GARESFIELD, ... Seam, Axwell Pit.
Shipping Ports—Dunston, Tyne Dock, and Sunderland.
Rail— . . . . Swalwell Station.
Canal— . . . .

Axwell Garesfield Coal.

Class of Coal—Gas.

Ultimate analysis—	Per cent.
Carbon	82·53
Hydrogen	4·77
Oxygen	6·82
Nitrogen	1·37
Sulphur	0·73
Ash	2·70
Water	1·08
	100·00

On submitting the coal to distillation in a coal-testing apparatus 10,500 cubic feet of gas were obtained per ton of coal, having an illuminating power equal to 16·4 standard sperm candles as ascertained by burning the gas at the rate of 5 cubic feet per hour in a photometer fitted with the No. 1 London Argand standard burner.

The coal yielded the following percentage amounts of coke and volatile matters:—

	Per cent.
Coke..	70·6
Volatile matters	29·4
	100·0

The resulting coke was of good quality.

The above results show that this is a good coal for gas-making purposes.

Analysts—J. and H. S. Pattinson.
Date of Analysis—September 5, 1892.

Notes.

DURHAM.

Collieries—WALDRIDGE, ... Seam, A., C. and D. Pits.
Shipping Ports—Dunston and Tyne Dock.
Rail— . . . . Station.
Canal— . . . .

Waldridge Gas Coal.

Class of Coal—Gas.

Ultimate analysis—	Per cent.
Carbon	82·31
Hydrogen	4·96
Oxygen	5·07
Nitrogen	1·40
Sulphur	1·10
Ash	4·30
Water	0·86
	100·00

On submitting the coal to distillation in a coal-testing apparatus 10,500 cubic feet of gas were obtained per ton of coal, having an illuminating power equal to 17·5 standard sperm candles as ascertained by burning the gas at the rate of 5 cubic feet per hour in a photometer fitted with the No. 1 London Argand standard burner. The coal yielded the following percentage amounts of coke and volatile matters :—

	Per cent.
Coke	69·2
Volatile matters	30·8
	100·0

The resulting coke is of good quality.

The above results show that this is an excellent coal for gas-making purposes.

Analysts—J. and H. S. Pattinson.
Date of Analysis—April 17, 1894.

Notes.

DURHAM.

OWNERS OF REDHEUGH COLLIERY,

Gateshead-on-Tyne.

Colliery—REDHEUGH, ... Seam, ... Pit.
Shipping Ports—Dunston, Tyne Dock, Northumberland Dock, and South and North Blyth.
Rail— . . . . Station.
Canal— . . . .

Redheugh Tanfield Coal.

Class of Coal—Gas, Coking.

Yield of gas per ton of coal	10,500 cubic feet
Illuminating power of gas in standard candles	14·1 candles
Coke per ton of coal	1,646 lb.
Appearance of coke	Good

	Per cent.
Coke	73·5
Volatile matters	26·5
	100·0

	Per cent.
Ash in coal	3·35
Sulphur in coal	0·56

Analyst—W. W. Proctor.
Date of Analysis—October 23, 1903.

Messrs. U. A. RITSON & SONS LIMITED,

Milburn House, Newcastle-on-Tyne.

Collieries—BURNHOPE and SOUTH PONTOP, ... Seam, ... Pit.
Shipping Ports—Tyne Dock and Sunderland.
Rail— . . . . Station.
Canal— . . . .

New Pelaw Gas Coal.

Class of Coal—Gas.

Ultimate analysis—	Per cent.
Carbon	83·45
Hydrogen	5·14
Oxygen	4·72
Nitrogen	1·32
Sulphur	1·11
Ash	3·10
Water	1·16
	100·00

Notes.

DURHAM.

New Pelaw Gas Coal—*cont.*

On submitting the coal to distillation in a coal-testing apparatus, 10,500 cubic feet of gas were obtained per ton of coal, having an illuminating power equal to 16·2 standard sperm candles, as ascertained by burning the gas at the rate of 5 cubic feet per hour in a photometer fitted with the No. 1 London Argand standard burner.

The illuminating value of the coal per ton expressed in pounds of sperm is 585.

The coal yielded the following percentage amounts of coke and volatile matters :—

	Per cent.
Non-volatile matters (coke)	69·4
Volatile matters, including water, expelled at a red heat in a closed vessel	30·6
	100·0

It coked well, giving a good hard clean coke.

The above results show that this is a good coal for gas-making purposes.

Analysts—J. and H. S. Pattinson.

Date of Analysis—February 22, 1905.

S. A. SADLER LIMITED,

Middlesbrough.

Colliery—ETHERLEY GRANGE. . . . . . . Seam, Woodhouses Pit.

Shipping Ports—Hartlepools, Sunderland and Tyne Dock.

Rail—North Eastern, West Auckland Station.

Canal— . . . . . .

Etherley Grange Gas Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

Yield of gas per ton of coal	11,032 cubic feet.
Illuminating power	18 candles
Value of 1 ton in sperm	[illegible] lb.
Coke	13 cwt.
Ash	5·9 per cent.

Analyst— . . . . . .

Date of Analysis—December, 1903.

DURHAM.

Notes.

Etherley Crange Coking Coal.

Class of Coal—Coking.

	Per cent.
Volatile matters	29·73
Carbon	62·66
Ash	7·61

Analyst—. . . . . .
Date of Analysis— . . . .

Colliery—MALTON . . . . Seam, ... Pit.

Hill Top Gas Coal.

Class of Coal—Gas, Steam, Manufacturing.

Yield of gas per ton of coal	10,500 cubic feet
Illuminating power	17 sperm candles
Coke	70 per cent.
Volatile matters	29 per cent.
Ash	5·75 per cent.

Analyst—J. Preston.
Date of Analysis—February, 1904.

Malton Coking Coal.

Class of Coal—Coking.

	Per cent.
Volatile matters	21·15
Carbon	73·78
Ash	5·07

Analyst— . . . .
Date of Analysis— . . . .

Notes.

DURHAM.

SOUTH DERWENT COAL CO. LIMITED,

Annfield Plain, R.S.O.

Colliery—SOUTH DERWENT . . . . Seam, South Derwent and West Shield Row Pits.

Shipping Ports—Dunston-on-Tyne, Tyne Dock and Sunderland.

Rail—North Eastern, Annfield Plain Station.

Canal— . . . .

West Pelaw Main Gas Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

Yield of gas per ton of coal	10,600 cubic feet
Illuminating power	16·5 sperm candles
Coke	67·7 per cent.
Volatile matters	32·3 per cent.
Ultimate analysis—	Per cent.
Carbon	80·73
Hydrogen	4·87
Oxygen	6·24
Nitrogen	1·68
Sulphur	1·91
Ash	3·40
Water	1·17

Analysts—J. and H. S. Pattinson.

Date of Analysis— . . . .

Notes.

DURHAM.

SOUTH HETTON COAL COMPANY LIMITED

Sunderland.

Collieries—MURTON and SOUTH HETTON, Hutton Seam, ... Pit.

Shipping Ports—Sunderland and Seaham Harbour, &c.

Rail—North Eastern, South Hetton Colliery Sidings.

Canal— . . . .

Hutton Seam Gas Coal.

Class of Coal—Gas.

Yield of gas per ton of coal	10,500 cubic feet
Illuminating power	14·3 standard sperm candles
Coke	66·5 per cent.
Volatile matters	33·5 per cent.
Ultimate analysis—	Per cent.
Carbon	77·40
Hydrogen	4·31
Oxygen	9·42
Nitrogen	1·01
Sulphur	1·52
Ash	4·60
Water	1·74
	100·00

Analysts—J. and H. S. Pattinson.

Date of Analysis—1886.

Collieries—MURTON and SOUTH HETTON, Low Main Seam, ... Pit.

South Hetton Hartley Steam Coal.

Class of Coal—Steam.

	Per cent.
Carbon	81·82
Hydrogen	5·20
Oxygen	6·17
Nitrogen	1·65
Sulphur	0·88
Ash	2·20
Water	2·08
	100·00

Notes.

DURHAM.

South Hetton Hartley Steam Coal—*cont.*

	Per cent.
Non-volatile matters (coke, &c.) . . .	66·0
Volatile matters	34·0

Calorific power:—Weight of water evaporated from 212 degs. Fahr. by 1 lb. of the coal as determined in Thomson's calorimeter, 14·9 lb.

Analysts—J. and H. S. Pattinson.

Date of Analysis—November 5, 1902.

OWNERS OF SOUTH PELAW COLLIERY,

Newcastle-on-Tyne.

Colliery—SOUTH PELAW, Busty Seam, South Pelaw Pit.

Shipping Ports—Tyne Dock and Sunderland.

Rail— . . . . Station.

Canal— . . . .

South Pelaw (Busty Seam) Gas Coal.

Class of Coal—Gas and Steam.

Yield of gas per ton of coal	10,500 cubic feet
Illuminating power	16·0 candles
Coke (of good quality)	73·1 per cent.
Volatile matters	26·9 per cent.

	Per cent.
Carbon	80·40
Hydrogen	4·67
Oxygen	5·84
Nitrogen	1·41
Sulphur	1·27
Ash	5·35
Water	1·06
	100·00

Analysts—J. and H. S. Pattinson.

Date of Analysis—August 7, 1891.

Notes.

DURHAM.

Colliery—SOUTH PELAW, Low Main Seam, South Pelaw Pit.

South Pelaw (Low Main) Coal.

Class of Coal—Gas.

Yield of gas per ton of coal..	10,500 cubic feet
Illuminating power	16·3 standard sperm candles
Coke	68·7 per cent.
Volatile matters	31·3 per cent.

	Per cent.
Carbon	78·98
Hydrogen	4·71
Oxygen	7·39
Nitrogen	1·25
Sulphur	0·98
Ash	5·52
Water	1·17
	100·00

Analyst— . . . . . .

Date of Analysis— . . . . . .

Messrs. STRAKERS & LOVE,

Newcastle-on-Tyne.

Colliery—BRANDON, Hutton Seam, ... Pit.

Shipping Ports—Tyne Dock, South Dock, Sunderland, Middlesbrough Dock, and all north-east ports.

Rail— . . . . Station.

Canal— . . . .

Brandon (Hutton Seam) Gas Coal.

Class of Coal—Gas.

On submitting the coal to distillation in a coal-testing apparatus, 10,500 cubic feet of gas were obtained per ton of coal, having an illuminating power equal to 16·2 standard sperm candles, as ascertained by burning the gas at the rate of 5 cubic feet per hour, in a photometer fitted with the No. 1 London Argand standard burner.

The coal yielded the following percentage amounts of coke and volatile matters :—

	Per cent.
Coke..	71·5
Volatile matters	28·5
	100·0

Notes.

DURHAM.

Brandon (Hutton Seam) Gas Coal—*cont.*

A complete "ultimate" analysis of the coal was made, and the following results were obtained :—

	Per cent.
Carbon	80·51
Hydrogen	4·80
Oxygen	6·82
Nitrogen	1·44
Sulphur	2·07
Ash	3·00
Water	1·36
	100·00

Analysts—J. and H. S. Pattinson.

Date of Analysis—January 12, 1901.

Colliery—BRANCEPETH, ... Seam, ... Pit.

Brancepeth Gas Coal.

Class of Coal—Gas.

Average analysis after a full year's test at Harrogate Gasworks.

Yield of gas per ton	10,800 cubic feet.	
Illuminating power	16·2 candles.	
Coke	70·0 per cent.	
Tar	383 tons	From about 8,600 tons of coal carbonised.
Sulphate of ammonia, and ammoniacal liquor, or equivalent of sulphur ..	52½ tons	

Analyst— . . . . . .

Date of Analysis— . . . . . .

Colliery—BRANCEPETH, Hutton Seam, ... Pit.

Brancepeth Gas Coal (Hutton Seam).

Class of Coal—Gas.

Yield of gas per ton	10,500 cubic feet.
Illuminating power	16·2 candles.
Coke	68·5 per cent.
Volatile matters	31·5 per cent.

	Per cent.
Carbon	77·56
Hydrogen	4·82
Oxygen	9·36
Nitrogen	1·55
Sulphur	1·90
Ash	3·33
Water	1·48

Notes.

DURHAM.

The following is interesting as being the mean result of actual working tests of the Brancepeth gas coal at Woolwich, so long ago as 1852:—

Specific gravity of coal	1·275
Coke	72·5 per cent.
Volatile matter	26·5 per cent.
Coke per ton of coal	31 bushels (equal to about 10½ cwt.)
Gas per ton of coal	9,600 cubic feet
Illuminating power of 5 cubic feet of this gas, equal to	12·7 standard candles
Sulphur in the coal	1·2 per cent.
Ash in the coal	2·2 per cent.

Analyst— . . . .
Date of Analysis— . . . . . .

Colliery—BRANCEPETH, ... Seam, ... Pit.

Brancepeth Cannel Coal.

Class of Coal—Gas.

Yield of gas per ton of coal	11,500 cubic feet
Illuminating power	24 standard sperm candles
Coke	72·8 per cent.
Volatile matter	27·2 per cent.

	Per cent.
Carbon	74·51
Hydrogen	4·76
Oxygen	7·05
Nitrogen	0·67
Sulphur	0·56
Ash	12·06
Water	0·39
	100·00

Analyst— . . . .
Date of Analysis— . . . .

Notes.

DURHAM.

Colliery—BRANCEPETH, Busty Seam, ... Pit.

Brancepeth Busty Unscreened Coking Coals.

Class of Coal—Coking.

	Per cent.
Fixed carbon	67·31
Volatile hydrocarbons	25·61
Sulphur	0·78
Ash	5·10
Water	1·20
	100·00
Non-volatile matters (coke)	72·8
Volatile matters, including water, expelled at a temperature of 1,000 C. in a closed vessel	27·2
	100·0

Phosphorus .. .. 0·0035 per cent. on the coal.
Equivalent to .. .. 0·005 per cent. on the coke.

Analysts—J. and H. S. Pattinson.

Date of Analysis—September 11, 1906.

THRISLINGTON COAL COMPANY LIMITED,

West Cornforth.

Colliery—THRISLINGTON, Harvey and Busty Seams, Jane Pit.

Shipping Ports—Hartlepools, Sunderland and Middlesbrough.

Rail—North Eastern, West Cornforth Station.

Canal—*Nil.*

South Kelloe Gas Coal.

Class of Coal—Gas.

Yield of gas per ton of coal..	10,640 cubic feet.
Illuminating power	17·90 standard sperm candles
Sperm value of 1 ton of coal	653 lb. sperm

Analyst— . . . .

Date of Analysis— . . . .

DURHAM.

Notes.

TRIMDON COAL COMPANY,

Trimdon Grange, R.S.O., Co. Durham.

Colliery—DEAF HILL, Harvey Seam, Deaf Hill Pit.
Shipping Ports—Hartlepools and Sunderland.
Rail—North Eastern, Trimdon Station.
Canal— . . . .

Deaf Hill Gas Coal.

Class of Coal—Gas and Manufacturing.

Test of coal under ordinary working conditions at the gasworks at West Hartlepool:—

Fixed carbon	62·81 per cent.
Ash	1·17 per cent.
Moisture	1·14 per cent.
Volatile matter (containing 0·98 sulphur)	34·88 per cent.
Purified gas per ton of coal	10,006 cubic feet
Illuminating power	16·9 sperm candles
Coke	14 cwt. 3 qr. = 1,652 lb.
Ash in coke	1·17 per cent.
Tar produced per ton of coal	9·8 gallons
Ammoniacal liquor	27·0 gallons
Sulphur contained in 100 cubic feet of gas after passing through lime purifier ..	5·31 grains

The same coal (Deaf Hill) chemically analysed, resulted as follows:—

	Per cent.
Fixed carbon	63·88
Volatile matters	31·37
Ash	2·87
Sulphur	0·82
Moisture	1·06
Yield of gas per ton of coal	10,370 cubic feet
Illuminating power	$17\frac{1}{2}$ sperm candles
Equivalent of 1 ton of coal in pounds of sperm	622 lb.
Coke	66·75 per cent.

Analyst— . . . .
Date of Analysis— . . . .

Notes.

DURHAM.

WALLSEND AND HEBBURN COAL COMPANY LIMITED,

Newcastle-on-Tyne.

Colliery—HEBBURN, Hutton Seam, Bensham Pit.

Shipping Port—Tyne, Private Staiths.

Rail—North Eastern, Jarrow and Hebburn Stations.

Canal— . . . . . .

Hebburn Main Gas Coal.

Class of Coal—Gas, Manufacturing.

Samples taken from three different parts of the mines.

Yield of gas per ton of coal	10,600 ..	10,800 ..	10,600	cubic feet
Illuminating power of gas	16·5 ..	17·0 ..	16·6	standard sperm candles

These results were obtained on submitting the coals to distillation in a coal-testing apparatus and by burning the gas so obtained at the rate of 5 cubic feet per hour in a photometer fitted with the No. 1 London Argand standard burner.

The coals yielded the following percentage amounts of coke and volatile matters:

	Per cent.	Per cent.	Per cent.
Coke	69·5 ..	68·2 ..	70·1
Volatile matters	30·5 ..	31·8 ..	29·9
	100·0	100·0	100·0

All the coals coked well, and are good for gas-making purposes.

Analysts—J. and H. S. Pattinson.

Date of Analysis—August 7, 1900.

WASHINGTON COAL COMPANY LIMITED,

Washington, R.S.O.

Colliery— . . . . Seam, ... Pit.

Shipping Port— . . . . . .

Rail— . . . . . . Station.

Canal— . . . . . .

Washington Gas Coal.

Class of Coal—Gas.

The coal was submitted to distillation in a coal-testing apparatus at a temperature of 1,000 degs. Cent., and the gas yielded was measured. This gas was burnt in a photometer fitted with the No. 1 London Argand

DURHAM.

Notes.

standard burner, at such a rate as to give the maximum efficiency of illumination; the illuminating power was determined, and the proportionate illuminating power at the standard rate of consumption of 5 cubic feet per hour was calculated from the result.

Yield of gas per ton of coal	11,400 cubic feet.
Illuminating power of gas	15·1 standard sperm candles
Illuminating value of gas, expressed in sperm per ton of coal	590 lb.

The coal yielded the following percentage amounts of coke and volatile matters:—

	Per cent.
Coke	68·0
Volatile matters, including water, expelled at a temperature of 1,000 degs. Cent. in a closed vessel	32·0
	100·0

The coke was of good quality.

A complete ultimate analysis was made of the coal, and the following results were obtained:—

	Per cent.
Carbon	82·20
Hydrogen	5·18
Oxygen	4·81
Nitrogen	1·49
Sulphur	1·41
Ash	3·30
Water	1·61
	100·00

This is a good coal for gas-making purposes.

Analysts—J. and H. S. Pattinson.

Date of Analysis—November 9, 1905.

Washington Steam Coal.

Class of Coal—Steam.

A complete ultimate analysis was made, and showed the coal to contain:—

	Per cent.
Carbon	82·20
Hydrogen	5·18
Oxygen	4·81
Nitrogen	1·49
Sulphur	1·41
Ash	3·30
Water	1·61
	100·00

Notes.

DURHAM.

Washington Steam Coal—*cont.*

The coal yielded the following percentage amounts of coke and volatile matters :—

	Per cent.
Coke	68·0
Volatile matters, including water, expelled at a temperature of 1,000 degs. Cent. in a closed vessel	32·0
	100·00

The calorific value was determined and gave the following result:—

Pounds of water evaporated from 212 degs. Fahr. by 1 lb. of coal	15·3 lb.

This coal has high calorific value.

Analysts—J. and H. S. Pattinson.

Date of Analysis—November 9, 1905.

WEARDALE STEEL, COAL AND COKE COMPANY LIMITED,

Newcastle-on-Tyne.

Colliery— . . . . Seam, ... Pit.

Shipping Ports—Hartlepools, Seaham Harbour and Sunderland.

Rail— . . . . Station.

Canal— . . . .

Thornley Gas Coals.

Class of Coal—Gas.

Yield of gas per ton of coal..	10,500 cubic feet.
Illuminating power	16·9 sperm candles.
Coke	67·5 per cent.
Volatile matters	32·5 per cent.

	Per cent.
Carbon	83·24
Hydrogen	5·02
Oxygen	5·37
Nitrogen	1·70
Sulphur	0·58
Ash	2·73
Water..	1·36

Analyst— . . . .

Date of Analysis— . . . .

Notes.

DURHAM.

Colliery— . . . . Seam, ... Pit.
Shipping Ports—Tyne Dock and Sunderland.
Rail— . . . . Station.
Canal— . . . .

Weardale Coking Coal.

Class of Coal—Coking.

	Per cent.
Carbon	83·84
Hydrogen	4·73
Oxygen	3·75
Nitrogen	1·31
Sulphur	0·84
Ash	4·20
Water	1·33
	100·00
Coke assay—	
Coke	76·0
Volatile matters	24·0
	100·0

Analysts—J. and H. S. Pattinson.
Date of Analysis—December 6, 1901.

WEST MICKLEY COAL COMPANY LIMITED,

Newcastle-on-Tyne.

Colliery—ELTRINGHAM, ... Seam, West Mickley Pit.
Shipping Ports—Dunston, Tyne Dock, Commissioners' Staiths.
Rail— . . . . Stocksfield Station.
Canal— . . . .

Tyne Boghead Cannel Coal.

Class of Coal—Gas, Locomotive, Steam.

	Works analysis.	
	1885.	1886.
Yield of gas per ton of coal	13,155 ..	10,932 cubic feet
Gas from 1 cubic foot of coal ..	465·06 ..	422·83 cubic feet
Value of gas from 1 ton of coal in pounds sperm	1,723·81 ..	956·89 lb.
Illuminating power	38·22 ..	25·53 candles
Tar per ton of coal	19·51 ..	20·30 gallons
Ammoniacal liquor	1·72 ..	11·26 gallons

Notes.

DURHAM.

Tyne Boghead Cannel Coal—*cont.*	Works analysis. 1885.	1886.
Strength of liquor	8·00	4·00 degs. Tw.
Coke per ton of coal	1,301·88	1,417·92 lb.
Carbon in coke	82·80	77·60 per cent.
Ash in coke	17·20	22·40 per cent.
Sulphur in coke	5·82	7·84 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	11·37	10·65 lb.

The average of analyses at Cheltenham Gasworks in 1886, after many tests, gave the following particulars of the Tyne Boghead cannel coal:—

Yield of gas per ton of coal	11,700 cubic feet.
Illuminating power	38·5 candles
Coke	11 cwt.

the manager (R. O. Patterson) adding:—"In my opinion it is superior to the best Lesmahagow; indeed, it is the richest cannel at present raised in any quantity in Great Britain."

Analyst— . . . . . .

Date of Analysis— . . . . . .

West Mickley Unscreened Gas Coals.

Class of Coal—Gas.

On submitting the coal to distillation in a coal-testing apparatus, 11,500 cubic feet of gas were obtained per ton of coal, having an illuminating power equal to 18·5 standard sperm candles as ascertained by burning the gas at the rate of 5 cubic feet per hour in a photometer fitted with the No. 1 London Argand standard burner.

The coal yielded the following percentage amounts of coke and volatile matters:—

	Per cent.
Coke	64·0
Volatile matters	36·0
	100·0

A complete "ultimate" analysis of the coal was made, and the following results were obtained:—

	Per cent.
Carbon	82·15
Hydrogen	4·91
Oxygen	6·56
Nitrogen	1·51
Sulphur	0·39
Ash	2·64
Water	1·84
	100·00

The above results show that this is a good coal for gas-making purposes.

Analysts—J. and H. S. Pattinson.

Date of Analysis—March 9, 1900.

DURHAM.

Notes.

OWNERS OF WEST STANLEY COLLIERY,

Newcastle-on-Tyne.

Colliery—WEST STANLEY, ... Seam, West Stanley Pit.

Shipping Ports—Sunderland, Tyne Dock, Blyth, Dunston, Howden and Albert Edward Docks, and Commissioners' Spouts.

Rail— . . . . . . Shield Row Station.

Canal— . . . . . .

North Pelton Gas Coal.

Class of Coal—Gas.

Yield of gas per ton of coal	11,723 cubic feet
Illuminating power	16·90 sperm candles
Coke	1,552·32 lb.=64 per cent.
Ash in coke	1·74 per cent.
Sulphur in coke	0·85 per cent.

	Per cent.
Fixed carbon	68·10
Volatile hydrocarbons	28·59
Ash	1·20
Sulphur	1·18
Moisture	0·93

The following is the result of analysis of the same coal made eighteen years earlier than the above test:—

Yield of gas per ton of coal	10,000 cubic feet
Illuminating power	16 sperm candles
Coke	70·5 per cent.
Volatile matters	29·5 per cent.

Complete ultimate analysis—	Per cent.
Carbon	84·38
Hydrogen	5·04
Oxygen	6·09
Nitrogen	0·93
Sulphur	0·94
Ash	1·58
Water	1·04

Analyst—W. F. Keating Stock.

Date of Analysis—May 2, 1894.

Notes.

DURHAM.

West Stanley Coking Coal.

Class of Coal—Coking.

	Per cent.
Fixed carbon	69·84
Volatile hydrocarbons	24·73
Ash	3·80
Sulphur	0·63
Moisture	1·00
	100·00

	Per cent.
Coke	74·00
Ash in coke..	5·13
Sulphur in coke	0·48
Phosphorus in coke	0·0055

Analyst—W. F. Keating Stock.
Date of Analysis—August 28, 1903.

OWNERS OF WINGATE GRANGE COLLIERY,

Wingate, R.S.O., Co. Durham.

Colliery—WINGATE GRANGE, ... Seam, ... Pit.
Shipping Ports—The Hartlepools, Wear, Tees and Tyne.
Rail— . . . . . . Station.
Canal— . . . . . .

Harvey Seam Gas Coal.

Class of Coal—Gas.

Chemical analysis—

	Per cent.
Fixed carbon	62·61
Ash	4·68
Moisture	1·17
Volatile matter (containing 1·74 of sulphur)	31·54
	100·00

Commercial analysis—

Purified gas per ton of coal carbonised ..	10,500 cubic feet
Illuminating power of gas	16·9 standard candles
Coke per ton of coal (after slacking).. ..	1,635 lb.
Tar produced per ton of coal carbonised ..	9·75 gallons
Ammonia liquor per ton of coal 5 degs. Twad. (20 gallons of fresh water added per ton)..	35·6 gallons
Sulphur contained in 100 cubic feet of gas after passing through purifiers	8·25 grains

Durham.

Notes.

The above results were obtained at the West Hartlepool Gasworks during a period of three consecutive days with 170 tons of unscreened Harvey coal. The coal was used under ordinary gas-producing circumstances, each charge being of six hours' duration. This coal was clean, newly mined, and in exceptionally good condition, being soft and friable, laminated in structure and having shining layers of bright soft coal with charcoal partings ; it carbonised most freely.

Analyst—Thomas Bower, M.I.C.E.

Date of Analysis—May 5, 1902.

Notes.

GLOUCESTER.

THE BEDMINSTER, EASTON, KINGSWOOD AND PARKFIELD COLLIERIES LIMITED,

Easton Colliery, Bristol.

Colliery—PARKFIELD . . . . Seam, Parkfield Pit.

Shipping Ports— . . . .

Rail— . . . . Mangotsfield Station.

Canal— . . . .

Parkfield Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

	Per cent.
Volatile matter	37·90
Fixed carbon	57·90
Ash	4·20
	100·00

Coke .. 62·10 per cent. = 12 cwt. 1 qr. 23 lb. per 1 ton of coal.

	Per cent.
Total sulphur	2·24
Moisture	1·92
Analysis of the coke—	Per cent.
Ash	6·76
Sulphur	1·42
Fixed carbon	91·82
	100·00

Specific gravity of coal	1,271 (water 1,000)
Yield of gas per ton of coal at standard pressure and temperature	11,090 cubic feet.
Illuminating power of the gas by London Argand	16·4 candles
Value of 1 ton of coal in sperm	623·5 lb.

This is a very good gas coal, furnishing an excellent coke.

Analyst—Geo. R. Thompson.

Date of Analysis—July 15, 1904.

Notes.

GLOUCESTER.

Colliery—KINGSWOOD, Great Vein Seam, Kingswood Pit.
Shipping Ports— . . . .
Rail— . . . . Fishponds Station.
Canal— . . . .

Kingswood Steam Coal.

Class of Coal—Steam, Manufacturing, House.

	Per cent.
Carbon	81·82
Hydrogen	4·63
Oxygen	5·54
Nitrogen	1·39
Sulphur	0·92
Ash	4·10
Moisture	1·60
	100·00

	Per cent.
Coke	69·50
Fixed carbon	65·40
Volatile matter	30·50
Specific gravity of the coal	1,282 (water 1,000)
Value of the coal in calories	7,991 cal.
Evaporative power in pounds of water at 100 degs. Cent. per 1 lb. of coal ..	14·88 lb.

Analyst—Geo. R. Thompson.
Date of Analysis—July 15, 1904.

Mr. THOS. JOHNSON,

Prescott Street, Wigan

Colliery—CROWN, Park End, Forest of Dean, ... Seam, ... Pit.

Shipping Ports—Lydney, Newport, Cardiff and Sharpness.

Rail—Great Western and Midland, Park End Station.

Canal— . . . .

Crown Seam Coal.

Class of Coal—Gas and House.

A sample of this coal, representing the entire product of the seam, received from the Crown Collieries, Park End, Forest of Dean, gave on examination the following results :—

Notes.

GLOUCESTER.

Crown Steam Coal—*cont.*

Chemical analysis—	Per cent.
Water expelled at 212 degs. Fahr... ..	1·6
Volatile hydrocarbons	37·3
Fixed carbon	58·3
Ash	1·6
Sulphur	1·2
	100·00

Practical results—

Gas per ton of coal at 60 degs. F., and 30 in. bar.	13,500 cubic feet
Illuminating power of gas in standard candles	17 to 17½ candles
Value of 1 cubic foot of gas in sperm	420 grains
Value of gas in 1 ton of coal in sperm.. ..	810 lb.
Percentage of coke in coal	59·9 per cent.
Coke per ton of coal	1,341 lb.
Colour of ash	Light brown

The above coal yields a very large volume of gas of high illuminating power, and gives a good hard gas coke. The percentage of ash and sulphur in both coal and coke is low, and the small proportion of impurities in the coal renders the gas easy of purification.

Analyst—Wm. Jas. Orsman.

Date of Analysis—May 25, 1901.

Colliery—CROWN, ... Seam, ... Pit.

King Coal.

Class of Coal—Gas and House.

Practical results—	
Gas per ton at 60 degs. F., and 30 in. bar.	13,100 cubic feet
Illuminating power	18·5 candles
Value of 1 cubic foot in sperm	444 grains
Value of gas from 1 ton of coal in sperm	830 lb.
Liquid products—	
Tar, per ton	12 gallons
Ammoniacal liquor per ton..	20 gallons
Strength of ammoniacal liquor	3 degrees
Solid products—	
Coke, per ton	1,320 lb.
Ash, per ton	142 lb.

Notes.

GLOUCESTER.

Percentage composition—	Per cent.
Coke	58·9
Ash	6·2
Tar	6·3
Ammonia	1·6
Sulphur	1·3
Water expelled at 212 degs. Fahr.	1·4
Gas	24·3
	100·0

The volume of gas obtained from the above coal is very large and readily given off by the coal, and has a high illuminating power.

The coke is of good quality and of a light brown colour; it contains a very small percentage of ash, making the same very valuable.

Analyst—J. W. Wynne.

Date of Analysis— . . . .

Colliery—CROWN . . . . Seam, ... Pit.

Best Double Screened Gas Coal.

Class of Coal—Gas and House.

Gas per ton of coal at 60 degs. Fahr., and 30 in. bar	12,730 cubic feet
Illuminating power of gas in standard candles	20·5 candles
Value of 1 cubic foot of gas in sperm	425 grains
Value of gas from 1 ton of coal in sperm	820 lb.
Coke per ton of coal	1,345 lb.
Colour of ash	Light brown
Chemical analysis—	Per cent.
Water expelled at 212 degs. Fahr.	1·6
Volatile hydrocarbons	37·3
Fixed carbon	58·3
Ash	1·6
Sulphur	1·2
	100·0

The above coal yields a very large volume of gas of very high illuminating power, and gives a splendid coke very bright and clean. The percentage of ash and sulphur in both coke and coal is extremely low, and the small proportion of impurities in the coal renders the gas very easy of purification.

The foregoing results have been gained by a bench of four retorts on Drake's patent tube regenerators, and the engine worked at 1 in. vacuum. The coal burns off well in $4\frac{1}{2}$ hours.

Analyst—J. T. Wynne.

Date of Analysis— . . . .

Notes.

GLOUCESTER.

LYDNEY AND CRUMP MEADOW COLLIERIES COMPANY LIMITED,

Cinderford, Forest of Dean.

Colliery—CRUMPMEADOW, Churchway High Delf Seam, No. 3 Pit.

Shipping Ports—Lydney, Sharpness, Newport, Cardiff.

Rail—Great Western and Severn and Wye Joint, Cinderford Station.

Canal—*Nil.*

Crump Meadow "Churchway High Delf" Coal.

Class of Coal—Gas, House and Steam.

	Per cent.
Carbon	77·72
Hydrogen	4·59
Nitrogen	1·67
Oxygen	5·61
Sulphur	2·23
Ash	4·55
Moisture	3·63
	100·00

Evaporative power as given by Thomson's calorimeter:
1 lb. of the coal equals 13·5 lb. of water at 100 degs. Cent.
Calorific power of the coal equals 7,670 calories.

As a steam coal I consider it well up to the average South Wales coals, as its evaporative power is over 13 lb. of water, and the absence of tendency to clinker is greatly in its favour.

Analyst—G. R. Thompson.

Date of Analysis—1896.

Crump Meadow Churchway High Delf Rubble Coal.

Class of Coal—Gas, House and Coking.

Specific gravity of the coal..	1·269
Purified gas per ton of coal..	9,825 cubic feet.
Illuminating power of the gas	15·45 candles
Durability of 1 cubic foot by 5 in. jet flame	32 minutes
Coke per ton of coal (dry)	13¼ cwt.
Ash in coke	8 per cent.
1 cwt. of shell lime purifies..	10,100 cubic feet of gas
Tar per ton of coal	10 gallons
Ammoniacal liquor	15 gals. 4·10 degs. Twad.
Moisture expelled from coal at 212 degs. F.	2·70 per cent.
Volatile matter in the coal	35 per cent.
Solid products in the coal	65 per cent.

Above results were obtained in ordinary working with generator furnaces, no exhauster, and 3 in. of back pressure. The coke is hard and compact, and will stand transit well.

Analyst—Jas. Robb.

Date of Analysis—May 31, 1906.

Notes.

GLOUCESTER.

Crump Meadow Starkey Rubble Coal.

Class of Coal—Gas, House and Coking.

Specific gravity of the coal	1·271
Purified gas per ton of coal	10,500 cubic feet.
Illuminating power of gas	16·75 candles
Durability of 1 cubic foot by 5 in. jet flame	38 minutes
Coke per ton of coal (dry)	12½ cwt.
Ash in coke	3·89 per cent.
1 cwt. of shell lime purifies..	8,900 cubic feet of gas
Tar per ton of coal	10 gallons
Ammoniacal liquor per ton of coal ..	13 gals. 4·90 degs. Twad.
Moisture expelled from coal at 212 degs. F.	2·00 per cent.
Volatile matter in the coal	38·57 per cent.
Solid products	61·43 per cent.

Above results were obtained in ordinary working with generator furnaces, no exhauster, and 3 in. of back pressure. The coke is of good domestic quality, high heating value, and will command a ready sale.

Analyst—Jas. Robb.

Date of Analysis—May 31, 1906.

PARKEND DEEP NAVIGATION COLLIERIES LIMITED,

Lydney.

Colliery—PARKEND, Smiths Seam, Parkend and New Fancy Pits.

Shipping Ports—Lydney, Sharpness, Newport (Mon).

Rail—Severn and Wye Joint, Parkend and New Fancy Colliery Stations.

Canal— . . . . . .

Parkend House Coal.

Class of Coal—House.

Specific gravity of the coal, 1,285 (water being 1,000).

Fixed products or coke, 12 cwt. 8 lb.

The quantity of purified gas per ton at 30 in. bar. and 60 degs. Fahr. was 9,956 cubic feet.

The illuminating power of the gas when burned in "Sugg's London Argand," at a rate of 5 cubic feet per hour, was equal to the light of 15·88 spermaceti candles, each consuming 120 grains per hour.

Value of one ton of the coal in pounds of sperm, 542 lb.

Notes.

GLOUCESTER.

Parkend House Coal—*cont.*

The heating power of the coal is 13·33, or 1 lb. of this coal by its perfect combustion will convert 13·33 lb. of boiling water into steam.

Ultimate analysis—	Per cent.
Carbon	78·06
Hydrogen	5·24
Oxygen	10·40
Nitrogen	0·47
Sulphur	1·44
Ash	4·39
	100·00

Analyst—Alex. H. Fiddes.

Date of Analysis—March, 1887.

PARK IRON ORE AND COAL COMPANY LIMITED,

Lydney.

Colliery—NORCHARD, ... Seam, ... Pit.

Shipping Ports—Lydney, Sharpness, Newport and Cardiff.

Rail—Severn and Wye Joint, Colliery Sidings, Lydney Station.

Canal— . . . .

Trenchard Lydney Gas Coal.

Class of Coal—Gas.

Yield of gas per ton of coal	11,125 cubic feet.
Illuminating power	16·77 standard candles.
Value of 1 cubic foot of gas in grains of sperm	402 grains.
Value of gas per ton of coal in lb. of sperm	567 lb.
Yield of coke per ton of coal	1,419 lb.
Ash in coal per cent.	4·8 per cent.
Sulphur in coal	1·271 per cent.

Analyst—G. R. Thompson

Date of Analysis— . . . .

Notes.

GLOUCESTER

Colliery—NORCHARD, ... Seam, Trenchard Pit.

Trenchard Gas, Steam and House Coal.

Class of Coal—Gas, Steam and House.

	Per cent.
Carbon	79·09
Hydrogen	4·76
Oxygen	4·70
Nitrogen	1·80
Sulphur	2·17
Water	2·08
Ash	5·40
	100·00

The ash is of good red colour, and does not show any great tendency to clinker. The yield of coke per 1 ton of coal is 14 cwt. 94 lb., or 74·2 per cent., and the total volatile matter amounts to 25·8 per cent. The coke is hard, porous and metallic looking, and contains 1·58 per cent. of sulphur. The calculated calorific value of the sample is 7,883 calories per 1 lb. of coal, and the evaporative power as obtained by Thomson's calorimeter is 14·6 lb. of water per 1 lb. of coal. From a practical test of the gas yield of the coal, it is found that 1 ton of the coal produces 11,125 cubic feet of purified gas, corrected to standard pressure and temperature. The illuminating power of this purified gas, as taken by the London Argand burner, equals 14·65 candles. The specific gravity of the coal is 1·31 (water = 1·00).

Analyst—G. R. Thompson.

Date of Analysis—October 13, 1898.

The following test was recently carried out with Trenchard small coal (passed through a 2 in. riddle jigger screen), consumed under a Lancashire boiler at the Bristol Corporation Electricity Works.

Size of boiler	28 ft. by 8 ft., flues 3 ft. 2 in.
Kind of stoker	Vicar's mechanical.
Heating surface	1,007 square ft.
Grate area	30·2 square ft.
Duration of trial	6 hours.
Mean boiler pressure	121 lb. per square in.
Total weight of fuel fired	3,870 lb.
Total weight of ash and unconsumed combustible	616 lb.
Percentage of ash to fuel fired	15 per cent.
Fuel burnt per square ft. of grate per hour	21·3 lb.
Fuel burnt per hour	645 lb.

Notes.

GLOUCESTER.

Trenchard Small Coal—*cont.*

Total weight of water evaporated	26,400 lb.
Water evaporated per hour	4,400 lb.
Mean temperature of feed water	62 Fahr.
Pounds of water evaporated per pound of fuel	6·87 lb.
Pounds of water evaporated per pound of fuel from and at 212 Fahr.	8·24 lb.
Superheat of steam leaving boiler ..	Saturated.
Draught in side flues	0·59 in. of water.
CO_2 in flue gases	8·8 per cent.

General remarks:—A free burning strong coal, easily worked, has given excellent results.

Colliery—NORCHARD, ... Seam, High Delf Pit.

High Delf Lydney Coal.

Class of Coal—Steam and Gas.

Yield of gas per ton of coal	9.215 cubic feet
Illuminating power	15·46 standard candles
Carbonic acid	10·3 per cent.
Hydrocarbons absorbed by bromine ..	4·75 per cent.

Analyst—G. R. Thompson.

Date of Analysis— . . . .

PRINCESS ROYAL COLLIERY COMPANY LIMITED,

Bream, Lydney.

Colliery—FLOUR MILL, Coleford High Delf Seam, ... Pit.

Shipping Ports—Lydney and Sharpness.

Rail—Severn and Wye Joint, own sidings, Whitecroft Station.

Canal— . . . . . .

Coleford High Delf Gas Coal.

Class of Coal—Gas.

Yield of gas per ton of coal	9,700 cubic feet
Illuminating power	17·46 standard candles
Value of 1 cubic foot of gas in grains of sperm	419 grains
Value of gas from 1 ton of coal in sperm ..	580 lb.
Yield of coke per ton of coal	1,428 lb.
Ash in coal per cent.	3·02 per cent.
Sulphur in coal	2·062 per cent.

Analyst—J. S. Rowlands.

Date of Analysis—December 26, 1893.

Notes.

GLOUCESTER.

Coleford High Delf Seam, Gas Coal.

Class of Coal—Gas.

Specific gravity (water 1·000)	1·320
The quantity of purified gas per ton, at 30 in. bar. and 60 degs. Fahr., was	10,870 cubic feet
Sulphuretted hydrogen	0·42 per cent.
Carbonic acid	1·32 per cent.
The illuminating power of the gas by London standard Argand burner, consuming 5 cubic feet of gas per hour, is equal to	15·6 std. sp. candles
(Each consuming 120 grains per hour).	
Fixed products (coke)	59·60 per cent.
Volatile	40·40 per cent.
Sulphur in coal	0·82 per cent.
Ash	3·07 per cent.

Analyst—J. S. Rowlands.
Date of Analysis—December, 26, 1903.

Coleford High Delf Seam, Steam Coal.

Class of Coal—Steam.

	Per cent.
Carbon	79·64
Hydrogen	5·30
Nitrogen	1·21
Oxygen	8·50
Sulphur	0·88
Ash	4·04
Water	0·40
	99·97

Analyst—J. S. Rowlands.
Date of Analysis—December 26, 1893.

Colliery—PARK GATE, Yorkley Seam, ... Pit.

Yorkley Seam Coal.

Class of Coal—Gas.

Specific gravity (water 1·000)	1·320
Quantity of purified gas per ton, at 30 in. bar. and 60 degs. Fahr.	10,340 cubic feet
Sulphuretted hydrogen	0·85 per cent.
Carbonic acid	1·50 per cent.

Notes.

GLOUCESTER.

Yorkley Seam Coal—*cont.*

Illuminating power of the gas by London standard Argand burner, consuming 5 cubic feet of gas per hour, equal to .. .. (Each consuming 120 grains per hour).	15·4 std. sperm candles
Fixed products (coke)	63·25 per cent.
Volatile do.	36·75 per cent.
Sulphur in coal	2·41 per cent.
Ash	4·50 per cent.

Analyst—J. S. Rowlands.

Date of Analysis—July 1, 1903.

TRAFALGAR COLLIERY COMPANY LIMITED,

Drybrook.

Colliery—TRAFALGAR, Five Seams at Trafalgar Pit, as below.

Shipping Port—Lydney.

Rail—Midland and Great Western Joint, Drybrook Road Station.

Canal—Berkeley.

Smith Coal.

Class of Coal—House.

Specific gravity of coal (water as 1,000) ..		1,284
Weight of 1 cubic foot in pounds		80·25 lb.
Yield of gas per ton of 2,240 lb. at a temperature of 60 degs. Fahr., the barometer at 30 in.		10,100 cubic feet
The illuminating power of the gas by a London standard Argand burner		14·9 std. sperm candles
The illuminating matter contained in the gas obtained from 20 cwt. of the coal		515·9 lb. sperm
Coke, red hot, per ton ..	.. cwt. qrs. lb.	12 3 24
Coke, slacked out, per ton	.. cwt. qrs. lb.	15 1 6
Ammoniacal liquor per ton	.. gals. qts. pts.	13 1 1
Specific gravity		4½ degs. Twad. or 1,022
Tar		11 1 0
Specific gravity		30 degs. Twad., or 1,150

	Per cent.
Carbon in coal	78·12
Ash in coal..	5·49
Sulphur in coal	1·64
Oxygen in coal	7·96
Hydrogen in coal	5·23
Nitrogen in coal	1·56
	100·00

GLOUCESTER.

Notes.

"Absolute" calorific value and evaporating power represented in pounds of water at 212 degs. Fahr., capable of being converted into steam by the thorough combustion of 1 lb. of the coal	14·1 lb.

Analyst—Robert J. Tootill.
Date of Analysis—January 7, 1890.

Lowery Coal.

Class of Coal—House.

Specific gravity of coal (water as 1,000) ..		1,268
Weight of 1 cubic foot		79·25 lb.
Yield of gas per ton of 2,240 lb. at a temperature of 60 degs. Fahr., the barometer at 30 in.		10,760 cubic feet
The illuminating power of the gas by a London standard Argand burner		15·4 std. sperm candles
The illuminating matter contained in the gas obtained from 20 cwt. of the coal		568·12 lb. sperm
Coke, red hot, per ton ..	.. cwt. qrs. lb.	12 1 16
Coke, slacked out, per ton	.. cwt. qrs. lb.	14 2 19
Ammoniacal liquor per ton	..gals. qts. pts.	13 3 0
Specific gravity		4½ degs. Twad., or 1,021
Tar		11 0 0
Specific gravity		30 degs. Twad., or 1,150

	Per cent.
Carbon in coal	78·50
Ash	4·78
Sulphur	1·80
Oxygen	8·01
Hydrogen	4·92
Nitrogen	1·99
	100·00

"Absolute" calorific value and evaporating power represented in pounds of water at 212 degs. Fahr. capable of being converted into steam by the thorough combustion of 1 lb. of the coal	14·75 lb.

Analyst—Robert J. Tootill.
Date of Analysis—January 7, 1890.

Notes.

Gloucester.

Starkey Coal.

Class of Coal—House.

Specific gravity of coal (water as 1,000) ..	1,276
Weight of 1 cubic foot	79·75 lb.
Yield of gas per ton of 2,240 lb. at a temperature of 60 degs. Fahr., the barometer at 30 in.	10,900 cubic feet
The illuminating power of the gas by a London standard Argand burner	15·2 std. sperm candles
The illuminating matter contained in the gas obtained from 20 cwt. of the coal	569·75 lb. sperm
Coke, red hot, per ton .. .. cwt. qrs. lb.	12 2 27
Coke, slacked out, per ton .. cwt. qrs. lb.	14 3 26
Ammoniacal liquor per ton .. gals. qts. pts.	12 3 1
Specific gravity	4 degs. Tw., or 1,020
Tar	12 1 0
Specific gravity	30½ degs. Tw., or 1,152

	Per cent.
Carbon in coal	78·3
Ash in coal	4·9
Sulphur in coal	1·6
Oxygen in coal	7·9
Hydrogen in coal	5·1
Nitrogen	2·2
	100·0

"Absolute" calorific value and evaporating power represented in pounds of water at 212 degs. Fahr. capable of being converted into steam by the thorough combustion of 1 lb. of the coal .. .. 14·9 lb.

Analyst—Robert J. Tootill.

Date of Analysis—January 7, 1890.

Notes.

GLOUCESTER.

Rocky Coal.

Class of Coal—House.

Specific gravity of coal (water as 1,000)	..	1,275
Weight of 1 cubic foot	..	79·6 lb.
Yield of gas per ton of 2,240 lb. at a temperature of 60 degs. Fahr., the barometer at 30 in.		11,250 cubic feet.
The illuminating power of the gas by a London standard Argand burner	..	16 std. sperm candles
The illuminating matter contained in the gas obtained from 20 cwt. of the coal	..	610·6 lb. sperm
Coke, red hot, per ton	cwt. qrs. lb.	12 3 6
Coke, slacked out, per ton	cwt. qrs. lb.	15 2 19
Ammoniacal liquor per ton	gals. qts. pts.	14 0 0
Specific gravity	..	$3\frac{3}{4}$ degs. Tw., or 1,018
Tar	..	12 0 0
Specific gravity	..	29 degs. Tw., or 1,145

	Per cent.
Carbon in coal	80·55
Ash in coal	3·16
Sulphur in coal	0·91
Oxygen in coal	8·40
Hydrogen in coal	5·30
Nitrogen in coal	1·68
	100·00

"Absolute" calorific value and evaporating power represented in pounds of water at 212 degs. Fahr., capable of being converted into steam by the thorough combustion of 1 lb. of the coal ..	15·4 lb.

Analyst—Robert J. Tootill.
Date of Analysis—January 7, 1890.

Notes.

GLOUCESTER.

Churchway High Delf Coal.

Class of Coal—House.

Specific gravity of coal (water as 1,000) ..	1,280
Weight of 1 cubic foot	80 lb.
Yield of gas per ton of 2,240 lb. at a temperature of 60 degs. Fahr., the barometer at 30 in.	11,100 cubic feet
The illuminating power of the gas by a London standard Argand burner	15·6 std. sperm candles
The illuminating matter contained in the gas obtained from 20 cwt. of the coal	593·7 lb. sperm
Coke, red hot, per ton .. .. cwt. qrs. lb.	13 0 5
Coke, slacked out, per ton .. cwt. qrs. lb.	16 1 0
Ammoniacal liquor per ton ..gals. qts. pts.	13 2 0
Specific gravity	4 degs. Twad., or 1,020
Tar	11 2 0
Specific gravity	31 degs. Twad., or 1,155

	Per cent.
Carbon in coal	79·0
Ash in coal..	4·5
Sulphur in coal	1·5
Oxygen in coal	8·2
Hydrogen in coal	5·0
Nitrogen in coal	1·8
	100·0

"Absolute" calorific value and evaporating power represented in pounds of water at 212 degs. Fahr., capable of being converted into steam by the thorough combustion of 1 lb. of the coal .. .. 15·2 lb.

Analyst—Robert J. Tootill.

Date of Analysis—January 7, 1890.

Notes.

LANCASHIRE.

ABRAM COAL COMPANY LIMITED,

Bickershaw, Wigan.

Colliery—ABRAM, Wigan Four Feet Seam, No. 2 Pit.
Shipping Ports—Garston, Partington, Runcorn, High Level, Preston, Widnes, Herculaneum Dock.
Rail—L. and N. W. and Gt. Central, Abram Colliery Sidings.
Canal—Leeds and Liverpool, Plank Lane Tip.

Wigan Four-feet Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

Yield of gas per ton of coal	10,250 cubic feet
Specific gravity of coal	1,270
Condensation by bromine	3·75 per cent.
Illuminating power	15·62 standard candles
Value of 1 cubic foot	375 grains sperm
Value of gas per ton of coal	549 lb. sperm
Gas purified by 1 cwt. of lime	11,000 cubic feet
Yield of coke per ton of coal	1,307 lb.
Ash in coke	5·66 per cent.

Analyst—Ralph Betley.
Date of Analysis— . . . .

Colliery—ABRAM, Wigan Five Feet Seam, No. 2 Pit.

Wigan Five-feet Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

Yield of gas per ton of coal	11,000 cubic feet
Specific gravity of coal	1,276
Condensation by bromine	3·50 per cent.
Illuminating power	14 standard candles
Value of 1 cubic foot	336 grains sperm
Value of gas per ton of coal	532·8 lb. sperm
Gas purified by 1 cwt. of lime	13,000 cubic feet
Yield of coke per ton of coal	1,315 lb.
Ash in coke	7·05 per cent.

Analyst—Ralph Betley.
Date of Analysis— . . . .

Notes.

Lancashire.

Colliery—Abram, Six-feet Seam, No. 5 Pit.

Wigan Six-feet Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

Yield of gas per ton of coal	10,500 cubic feet
Specific gravity of coal	1,235
Condensation by bromine	3·75 per cent.
Illuminating power	15·76 standard candles
Value of 1 cubic foot	378 grains sperm
Value of gas per ton of coal	567·36 lb. sperm
Gas purified by 1 cwt. of lime	12,000 cubic feet
Yield of coke per ton of coal	1,361 lb.
Ash in coke	6·88 per cent.

Analyst—Ralph Betley.

Date of Analysis— . . . .

Colliery—Abram, Arley Seam, No. 5 Pit.

Arley Mine Gas Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

Yield of gas per ton of coal	12,353 cubic feet
Specific gravity of coal	1,275
Condensation by bromine	5·25
Illuminating power	18·51 standard candles
Value of 1 cubic foot	444·24 grains sperm
Value of gas per ton of coal	783·95 lb. sperm
Gas purified by 1 cwt. lime	15,000 cubic feet
Yield of coke per ton of coal	1,463 lb.
Ash in coke	3·20 per cent.

Analyst—Geo. R. Hislop, F.C.S., etc.

Date of Analysis— . . . .

LANCASHIRE.

Notes.

Colliery—ABRAM, Haigh Yard Mine Seam, No. 5 Pit.

Orrell Five-feet Coal.

Class of Coal—Steam.

Yield of gas per ton of coal	11,575 cubic feet
Specific gravity of coal	1,284
Condensation by bromine	6·00 per cent.
Illuminating power	20·7 candles
Value of 1 cubic foot	497·04 grains sperm
Value of gas per ton of coal	821·89 lb.
Yield of coke per ton of coal	1.409·63 lb.
Ash in coke..	5·80 lb.

Analyst—Geo. R. Hislop, F.C.S., etc.

Date of Analysis— . . . .

Colliery—ABRAM, Wigan Four Feet Seam, No. 5 Pit.

Abram New Boghead Cannel.

Class of Coal—Gas.

Yield of gas per ton of coal	16,680 cubic feet
Specific gravity of coal	1,116
Condensation by bromine	18·80 per cent.
Illuminating power	42·46 candles
Value of 1 cubic foot	1,019·4 grains
Value of gas per ton of coal	2,428·22 lb.
Yield of coke per ton of coal	919·96 lb.
Ash in coke..	4·60 per cent.

Analyst—Geo. R. Hislop, F.C.S., etc.

Date of Analysis— . . . .

Notes.

LANCASHIRE.

BISPHAM HALL COLLIERY COMPANY,

Orrell, near Wigan.

Colliery—BISPHAM HALL, Middle Mountain Mine Seam, Gauntley Pit.

Shipping Ports—Liverpool and Garston.

Rail—Lancashire and Yorkshire, Orrell Station (Orrell West Siding).

Canal—*Nil.*

Mountain Mine Nuts.

Class of Coal—Gas, Steam, Manufacturing, House.

The following is the result obtained from six wagons of gas coal nuts subjected to a practical working test over a run of fifteen hours:—

Purified gas per ton	11,200 cubic feet
Average illuminating power	16·25 sperm candles
Illuminating matter per ton	624·00 lb. sperm
Coke per ton	1,601 lb.
Coke	71·47 per cent.
Fixed carbon in coke	96·30 per cent.
Ash	3·70 per cent.

The yield of coke is high and of good quality, clean and possessing good heating power.

Analyst—Joseph Timmins.

Date of Analysis—May 15, 1903.

BLAINSCOUGH COLLIERY COMPANY LIMITED,

Coppull, Chorley.

Colliery—WELCH WHITTLE, Arley Seam, Welch Whittle Pit.

Shipping Ports—Preston and Garston.

Rail—L. and N. W., Coppull Station.

Canal— . . . . . .

Blainscough Arley Gas Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

A sample of this coal, representing the entire product of the seam, gave on examination the following results:—

		Per cent.
Chemical analysis—		
Volatile matter (containing 0·65 of sulphur)		31·63
Coke, consisting of		
Carbon	60·31	
Sulphur	0·17	
Ash	4·14	
		64·62
Water expelled at 212 degs. Fahr... ..		3·75
		100·00

Notes.

LANCASHIRE.

Practical results :—	
Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	11,552 cubic feet
Gas from 1 cubic foot of the coal	408·03 cubic feet
Specific gravity of the gas	486 (air 1,000)
Value of gas from 1 ton of coal in sperm..	765·20 lb.
Illuminating power of gas in standard candles (per London Argand)	19·32 candles
Liquid products—	
Tar per ton of coal	12·40 gallons
Ammoniacal liquor per ton of coal ..	15·10 gallons
Strength of ammoniacal liquor	2·70 degs. Twadd.
Solid products—	
Coke per ton of coal..	1,447·48 lb.
Carbon in the coke	93·60 per cent.
Ash in the coke	6·40 per cent.
Sulphur in coke per ton of coal	3·87 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	12·86 lb.

This is an excellent gas coal, and as such yields a large volume of 19·32 candle gas, and at same time affording 12·92 cwt. per ton of very good coke. This coal possesses a moderate aqueous absorbent capacity, and is consequently a fairly dry one.

Analyst—Geo. R. Hislop, F.C.S., F.I.Inst., F.R.S.S.A.
Date of Analysis—June 8, 1895.

CHAMBER COLLIERY COMPANY LIMITED,

Hollinwood, Oldham.

Collieries—WOODPARK, Ashton-under-Lyne, STOCKFIELD, Chadderton, OAK, Hollinwood, ... Seam, ... Pit.

Shipping Ports—Nil.

Rail—L. and Y. Railway Co., Stockfield, Werneth, Oldham and Hollinwood Stations.

Canal—Great Northern Railway Canal, Woodhouses, near Ashton-under-Lyne.

Chamber Colliery Gas Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

The following are the results of three analyses of this coal :—

A—Gas per ton of coal	10,500 cubic feet
Illuminating power	19·90 candles
Value of gas from 1 ton of coal	716 lb. sperm

Notes.

LANCASHIRE.

Chamber Colliery Gas Coal—*cont.*

B—Gas per ton of coal	10,460 cubic feet
Illuminating power	19·67 candles
Value of gas from 1 ton of coal	705 lb. sperm
C—Gas per ton of coal	11,600 cubic feet
Illuminating power	19 candles
Value of gas from 1 ton of coal	755 lb. sperm

Analyst— . . . .

Date of Analysis— . . . .

CHORLEY COLLIERY COMPANY LIMITED,

Moor Road, Chorley.

Colliery—MOOR ROAD, Mountain Mine Seam, Mountain Mine Pit.

Shipping Ports—Garston, Liverpool.

Rail—L. and N. W., and Lancashire and Yorkshire, Chorley Station.

Canal—*Nil.*

Chorley Colliery Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

Purified gas per ton	11,266	cubic feet
Average illuminating power, corrected for temperature and barometric pressure ..	15·5	sperm candles
Illuminating matter per ton	598·70	lb. sperm
Coke per ton	1,487	lb.
Coke	63·38	per cent.
Fixed carbon in coke	96·90	per cent.
Ash in coke	3·10	per cent.

Analyst—Joseph Timmins, Assoc.M.Inst.C.E.

Date of Analysis—May 21, 1897.

LANCASHIRE.

Notes.

COLLINS GREEN COLLIERY COMPANY LIMITED,

Earlestown.

Colliery—COLLINS GREEN, ... Seam, No. 1 Pit.
Shipping Ports—Garston, High Level, Herculaneum.
Rail—L. and N. W., Collins Green Station.
Canal—*Nil.*

Pemberton (4 ft.) Coal.

Class of Coal—House and Gas.

A sample of this coal, representing the entire product of the seam, gave on examination the following results:—

The coal is black, possesses considerable lustre and brown streak. Fracture rather irregular, chiefly defined by slight deposits of charcoal. Cross-fracture partly cubical and resinoid, and laminated with brownish splinted coal, and contains considerable deposits of calcium carbonate, with trace of ferric bisulphide. Moderately cohesive and compact. Under distillation it intumesces and agglomerates. Colour of ash, dark brown. The coal is of very uniform density, mean specific gravity being 1,230 (water 1,000). Weight of 1 cubic foot, 76·87 lb.

		Per cent.
Volatile matters (containing 0·59 of sulphur)		33·70
Coke, consisting of—		
Carbon	54·92	
Sulphur	0·16	
Ash	5·12	
		60·20
Water expelled at 212 degs. Fahr... ..		6·10
		100·00

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	11,150 cubic feet
Gas from 1 cubic foot of the coal	382·63 cubic feet
Specific gravity of the gas	482 (air 1,000)
Hydrocarbons absorbed by bromine ..	5·50 per cent.
Durability of 1 cubic foot by 5 in. jet flame	41 min. 16 sec.
Value of 1 cubic foot of gas	452·64 grains sperm
Value of gas from 1 ton of coal	735·54 lb. sperm
Illuminating power of gas in standard candles (per London Argand)	18·86 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·75 per cent.
Carbonic acid (CO_2) in foul gas	4·50 per cent.
Carbonic oxide (CO) in foul gas	6·10
Sulphur eliminated with volatile products	13·22 lb.

Notes.

LANCASHIRE.

Pemberton (4-ft.) Coal—*cont.*

Liquid products—

Tar per ton of coal	13·60 gallons
Ammoniacal liquor per ton of coal ..	23·40 gallons
Strength of ammoniacal liquor	3·00 degs. Twadd.
Hygrometric water per ton of coal ..	13·66 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	7·50 gallons.

Solid products—

Coke per ton of coal	1,348·48 lb.
Carbon in the coke	91·50 per cent.
Ash in the coke	8·50 per cent.
Sulphur in coke per ton of coal	3·58 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)..	12·57 lb.

This coal yields a considerable volume of gas of high quality, and at same time affords 12 cwt. of good coke per ton. It contains about the average of sulphur and water.

Analyst—George R. Hislop, F.C.S., etc.

Date of Analysis—January 27, 1900.

Colliery—BOLD, ... Seam, No. 2 Pit.

Collins Green Cannel Coal.

Class of Coal—Gas.

A sample of this coal, representing the entire product of the seam, gave on examination the following results:—

The coal is black, possesses considerable to moderate lustre, and yellowish brown streak; fracture irregular and coarse to curly with impressions of stigmaria; cross fracture angular and curly and exhibiting numerous small shining planes, and some nuggets of bright coal conchoidal in all directions, as also deposits of calcium carbonate and ferric bisulphide in the natural partings; very cohesive and compact; under distillation it intumesces and agglomerates; colour of ash, pale brown. Thickness of seam 29 in., and of very uniform density. Mean specific gravity 1,198 (water 1,000). Weight of 1 cubic foot, 74·87 lb.

		Per cent.
Volatile matters (containing 0·33 of sulphur)		46·14
Coke consisting of—		
Carbon	47·18	
Sulphur	0·17	
Ash	2·76	
		50·11
Water expelled at 212 degs. Fahr... ..		3·75
		100·00

LANCASHIRE.

Notes.

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar.	13,440 cubic feet
Gas from 1 cubic foot of the coal	449·22 cubic feet
Specific gravity of the gas	638 (air 1,000)
Hydrocarbons absorbed by bromine ..	13·50 per cent.
Durability of 1 cubic foot by 5 in. jet flame	67 min. 28 sec.
Value of 1 cubic foot of gas	858·72 grains sperm
Value of gas from 1 ton of coal	1,648·74 lb. sperm
Illuminating power of gas in std. candles..	35·78 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·00 per cent.
Carbonic acid (CO_2) in foul gas	2·50 per cent.
Carbonic oxide (CO) in foul gas	7·66 per cent.
Sulphur eliminated with volatile products	7·40 lb.
Liquid products—	
Tar per ton of coal	22·40 gallons
Ammoniacal liquor per ton of coal ..	14·80 gallons
Strength of ammoniacal liquor	2·75 degs. Twadd.
Hygrometric water per ton of coal ..	8·40 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	5·10 per cent.
Solid products—	
Coke per ton of coal	1,122·46 lb.
Carbon in the coke	94·50 per cent.
Ash in the coke	5·50 per cent.
Sulphur in coke per ton of coal	3·80 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)..	12·98 lb.

This is a remarkably good and pure cannel coal of the first class, and as such is without one detracting property, since while yielding a large volume of 35·78-candle gas, it affords 10 cwt. of first-class coke per ton, and contains very moderate amounts of sulphur and water.

Analyst—George R. Hislop, F.C.S., etc.
Date of Analysis—June 12, 1897.

Notes.

LANCASHIRE.

CROSS, TETLEY AND CO. LIMITED,

Bamfurlong, Wigan.

Colliery—BAMFURLONG AND MAINS, Deep Arley Seam, Bamfurlong Pit.

Shipping Ports—Garston, High Level, Herculaneum, Runcorn, Widnes, Ellesmere Port, Partington, Fleetwood, Preston.

Rail—L. and N. W., Bamfurlong and Mains Private Sidings.

Canal—Leeds and Liverpool, Pierhead alongside Bamfurlong Colliery.

Best Deep Wigan Arley Coal.

Class of Coal—Gas and House.

Proximate analysis—	Per cent.
Moisture	1·13
Volatile products	33·49
Fixed carbon	60·01
Sulphur	1·92
Ash (colour, brown)	3·45
Specific gravity	1,280
Weight of 1 cubic foot of coal	80 lb.
Space occupied by 1 ton	28 cubic feet
Commercial analysis—	
Gas made per ton of coal	11,233 cubic feet
Gas made per cubic foot of coal	401 cubic feet
Illuminating power	17·42 candles
Sperm value of 1 cubic foot of gas	418 grains sperm
Sperm value per ton	671 lb.
Coke per ton of coal	1,431 lb.
Coke per cent.	63·9 per cent.
Ash in coke per cent.	5·4 per cent.
Sulphur eliminated with volatile products per ton of coal	19·0 lb.
Sulphur in coke per ton of coal	24·0 lb.

Analyst—T. O. Paterson, C.E., F.G.S.

Date of Analysis—June 21, 1899.

Notes.

LANCASHIRE.

Colliery—BAMFURLONG AND MAINS, Wigan Four Feet Seam, Mains Pit.

Wigan Four-feet Cannel.

Class of Coal—Gas.

Specific gravity of cannel (water as 1,000) ..	1,220
Weight of 1 cubic foot	76·25 lb.
Fixed carbon in cannel	95·66 per cent.
Ash in cannel	4·34 per cent.
Purified gas per ton	15,400 cubic feet
Gas per cubic foot of coal	524·34 cubic feet
Illuminating power of gas consumed in a No. 4 flat-flame burner, naked light, in sperm candles	39·88 candles
Value of 1 cubic foot in sperm	957·12 grains
Weight of illuminating matter in sperm ..	2,105·66 lb.
Weight of coke per ton of cannel	1,080 lb.
Percentage of coke in coal	48·21 per cent.
Fixed carbon in coke	91·0 per cent.
Ash in coke..	9·0 per cent.

Analysts—James Paterson, C.E., F.G.S.

Date of Analysis—July 3, 1891.

Wigan Four-feet Gas Coal.

Class of Coal—Gas.

The following is the result of an examination of three wagons of coal:—

	No. 1.	No. 2.	No. 3.
Specific gravity	1,264..	1,256..	1,269
Weight of 1 cubic foot	79..	78·5 ..	79·31 lb.
Sulphur in coal	— ..	— ..	— per cent.
Purified gas per ton	11,600..	10,700..	11,200 cubic feet
Gas per cubic foot of coal ..	409·1 ..	375·06 ..	396·56 cubic feet
Illuminating power of the gas..	22·37 ..	20·9 ..	20·16 std. candles
Value of 1 cubic foot of gas ..	536·88 ..	501·60 ..	483·84 grains sperm
Value of 1 ton of coal	889·68 ..	766·73 ..	774·14 lb. sperm
Coke per ton of coal	1,213..	1,291..	1,306 lb.
Ash in coke	7·00 ..	8·00 ..	5·00 per cent.
Fixed carbon in coke	93·00 ..	92·00 ..	95·00 per cent.
Sulphur per ton of coal.. ..	— ..	— ..	— lb.

Analysts—James Paterson, C.E., F.G.S.

Date of Analysis—June 12, 1893.

Notes.

LANCASHIRE.

Wigan Six-feet Coal.

Colliery—BAMFURLONG and MAINS, Wigan Six-feet Seam, Bamfurlong Pit.

Class of Coal—Steam, Gas, House, Manufacturing.

	Per cent.
Water expelled at 212 degs. Fahr.	2·8
Volatile hydrocarbons	33·4
Fixed carbon	60·4
Ash	2·2
Sulphur	1·2
	100·0

Gas per ton of coal at 60 degs. F. and 30 in. bar.	10,500 cubic feet
Illuminating power of gas in standard candles	18 candles
Percentage of coke in coal	62·6 per cent.
Coke per ton of coal	1,402 lb.
Colour of ash	Light red grey.

The above coal gives a good yield of gas of high illuminating power. The ash is low. The coke is short and rather brittle.

Analyst—Wm. Jas. Orsman, F.I.C., F.C.S.

Date of Analysis—September 23, 1904.

Trencherbone Coal.

Colliery—BAMFURLONG and MAINS, Trencherbone Seam, Mains Pit.

Class of Coal—Gas, Steam, Manufacturing, House.

	Per cent.
Water expelled at 212 degs. Fahr.	2·4
Volatile hydrocarbons	34·8
Fixed carbon	60·0
Ash	1·9
Sulphur	0·9
	100·0

Gas per ton of coal at 60 degs. F. and 30 in. bar.	11,000 cubic feet
Illuminating power of gas in standard candles	17·5 candles
Percentage of coke in coal	61·9 per cent.
Coke per ton of coal	1,386 lb.
Colour of ash	Light grey

The above coal gives a good yield of gas, and is low both in ash and sulphur. The coke is rather brittle.

Analyst—Wm. Jas. Orsman, F.I.C., F.C S.

Date of Analysis—September 23, 1904.

LANCASHIRE.

Notes.

RICHD. EVANS AND CO. LIMITED,

Haydock, near St. Helens.

Colliery—GOLBORNE, ... Seam, No. 2 Pit.

Shipping Port— . . . . . .

Rail— . . . . . . Station.

Canal— . . . . . .

Colborne Gas Coal.

Class of Coal—Gas.

A sample of this coal, representing the entire product of the seam, gave on examination the following results:—

MINERALOGICAL CHARACTERS.—The coal is black, possesses moderate to considerable lustre and brown streak; fracture—largely defined by deposits of charcoal, while cross fracture is angular and crystalline to resinoid, with laminæ of brownish black splint coal and deposits of calcium carbonate with trace of ferric bisulphide in the natural partings. Moderately cohesive and compact; under distillation it intumesces and agglomerates; colour of ash, brown and white. Mean specific gravity, 75·81 lb.

Chemical analysis—		Per cent.
Volatile matters (containing 0·42 of sulphur)		36·37
Coke consisting of—		
Carbon	54·85	
Sulphur	0·13	
Ash	3·45	
		58·43
Water expelled at 212 degs. Fahr. ..		5·20
		100·00

Practical results (gaseous products)—	
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar.	12,620 cubic feet
Gas from 1 cubic foot of the coal	427·10 cubic feet
Specific gravity of the gas	496 (air 1·000)
Hydrocarbons absorbed by bromine ..	5·85 per cent.
Durability of 1 cubic foot by 5 in. jet flame	44 min. 9 sec.
Value of 1 cubic foot of gas	490·08 grains sperm
Value of gas from 1 ton of coal	883·54 lb. sperm
Illuminating power of gas in standard candles (per London Argand)	20·42 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·25 per cent.
Carbonic acid (CO_2) in foul gas	2·75 per cent.
Carbonic oxide (CO) in foul gas	7·25 per cent
Sulphur eliminated with volatile products	10·51 lb.

Notes.

LANCASHIRE.

Golborne Gas Coal—*cont.*

Liquid products—

Tar per ton of coal	15·85 gallons
Ammoniacal liquor, per ton of coal ..	19·80 gallons
Strength of ammoniacal liquor	3·00 degs. Twadd.
Hygrometric water per ton of coal ..	1·64 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	6·75 per cent.

Solid products—

Coke per ton of coal	1,308·83 lb.
Carbon in the coke	94·10 per cent.
Ash in the coke	5·90 per cent.
Sulphur in coke per ton of coal	2·91 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	12·92 lb.

This is a remarkably good gas coal, since in addition to a large yield of illuminating matter, it affords 11·68 cwt. of excellent coke per ton. The coal at same time contains a very moderate amount of sulphur with about the average percentage of water.

Analyst—Geo. R. Hislop, F.C.S., M.S.C. Ind., F.R.S.S.A.
Date of Analysis—October 13, 1898.

Colliery—GOLBORNE, Seven Feet Seam, Golborne No. 1 Pit.

Golborne Seven Feet Coal.

Class of Coal—Steam and Gas.

Chemical analysis—	Per cent.
Water expelled at 212 degs. Fahr... ..	4·1
Volatile hydrocarbons	34·6
Fixed carbon	58·2
Ash	2·2
Sulphur	0·9
	100·00

Practical results—

Gas per ton of coal at 60 degs. F., and 30 in. bar.	10,980 cubic feet
Illuminating power of gas in standard candles	17·5 candles
Percentage of coke in coal	60·5 per cent.
Coke per ton of coal	1,355 lb.
Colour of ash	Grey, brown

The above is a good steam-raising coal and gives a good yield of gas. The coke is hard, but rather porous.

Analyst—Wm. J. Orsman, F.I.C., F.C.S.
Date of Analysis— . . . .

Notes.

LANCASHIRE.

Colliery—GOLBORNE, Four-feet Seam, Golborne No. 2 Pit.

Golborne Four-feet Coal.

Class of Coal— . . . .

	Per cent.
Chemical analysis—	
Water expelled at 212 degs. Fahr.	4·8
Volatile hydrocarbons	35·0
Fixed carbon	55·7
Ash	3·5
Sulphur	1·0
	100·0
Practical results—	
Gas per ton of coal at 60 degs. F. and 30 in. bar.	12,300 cubic feet
Illuminating power of gas in standard candles	17·5 candles
Percentage of coke in coal	59·2
Coke per ton of coal	1,326 lb.
Colour of ash	Light red grey

The above yields a good supply of gas, and would make a good steam coal. The coke is also good and low in sulphur.

Analyst—Wm. Jas. Orsman, F.I.C., F.C.S.

Date of Analysis— . . . .

Colliery—GOLBORNE, Five-feet Seam, Golborne No. 2 Pit.

Golborne Five-feet Coal.

Class of Coal— . . . .

	Per cent.
Chemical analysis—	
Water expelled at 212 degs. Fahr.	4·1
Volatile hydrocarbons	34·8
Fixed carbon	57·3
Ash	2·1
Sulphur	1·7
	100·00
Practical results—	
Gas per ton of coal at 60 degs. F. and 30 in. bar.	13,000 cubic feet
Illuminating power of gas in standard candles	17·0 candles
Percentage of coke in coal	56·2 per cent.
Coke per ton of coal	1,258 lb.
Colour of ash	Light grey brown

The above yields a good supply of gas, and 57·8 per cent. of well-fused, hard, but rather porous coke, and the ash is low. The above would make a good household coal.

Analyst—Wm. Jas. Orsman, F.I.C., F.C.S.

Date of Analysis— . . . .

Notes.

LANCASHIRE.

Colliery—HAYDOCK, ... Seam, Princess Pit.

Princess Arley Gas Coal.

Class of Coal—Gas.

A sample of this coal, representing the entire product of the seam, gave on examination the following results:—

MINERALOGICAL CHARACTERS.—The coal is black, possesses considerable lustre and brown streak; fracture rather irregular, and chiefly defined by thin deposits of charcoal; cross fracture angular and resinoid to crystalline, inclining to columnar in the natural partings, with considerable deposits of calcium carbonate and some ferric bisulphide. Moderately cohesive and compact; under distillation it intumesces and agglomerates; colour of ash, purple brown. Mean specific gravity 1,239 (water 1,000); weight of one cubic foot, 77·43 lb.

		Per cent.
Chemical analysis—		
Volatile matters (containing 0·45 of sulphur)		33·30
Coke consisting of—		
Carbon	60·00	
Sulphur	0·14	
Ash	2·71	
		62·85
Water expelled at 212 degs. Fahr... ..		3·85
		100·00

Practical results (gaseous products)—	
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar	12,460 cubic feet
Gas from 1 cubic foot of the coal	430·70 cubic feet
Specific gravity of the gas	468 (air 1,000)
Hydrocarbons absorbed by bromine ..	5·75 per cent.
Durability of one cubic foot by 5 in. jet flame	40 mins. 34 secs.
Value of one cubic foot of gas	445·44 grains sperm
Value of gas from 1 ton of coal	792·88 lb. sperm
Illuminating power of gas in standard candles (per London Argand) ..	18·56 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·30 per cent.
Carbonic acid (CO_2) in foul gas	2·25 per cent.
Carbonic oxide (CO) in foul gas	6·60 per cent.
Sulphur eliminated with volatile products	10·11 lb.

LANCASHIRE.

Notes.

Liquid products—

Tar per ton of coal	15·40 gallons
Ammoniacal liquor per ton of coal ..	14·87 gallons
Strength of ammoniacal liquor	2·30 degs. Twadd.
Hygrometric water, per ton of coal ..	8·60 gallons
Aqueous absorbent capacity of coal (determined by complete saturation) ..	5·40 per cent.

Solid products—

Coke per ton of coal..	1,407·84 lb.
Carbon in the coke	95·70 per cent.
Ash in the coke	4·30 per cent.
Sulphur in coke per ton of coal	3·10 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)..	13·14 lb.

This is an excellent gas coal, yielding as it does a large volume of 18½-candle gas, and at the same time affording 12·57 cwt. of very pure coke per ton. The coal likewise contains moderate amounts of both sulphur and water.

Analyst—Geo. R. Hislop, F.C.S., M.S.C. Ind., F.R.S.S.A.
Date of Analysis—October 10, 1898.

Colliery—HAYDOCK, ... Seam, Princess Pit.

Princess Rushy Park Coal.

Class of Coal—Gas, House.

Chemical analysis—	Per cent.
Water expelled at 212 degs. Fahr... ..	4·1
Volatile hydrocarbons	33·9
Fixed carbon	59·1
Ash	2·0
Sulphur	0·9
	100·0

Practical results—

Gas per ton of coal at 60 degs. F. and 30 in. bar.	12,600 cubic feet
Illuminating power of gas in standard candles	17·5 candles
Percentage of coke in coal	61·2 per cent.
Coke per ton of coal	1,370 lb.
Colour of ash	Light brown

Good gas-making or household coal. The sulphur is low, and the coal would be an excellent one for coking purposes.

Analyst—Wm. Jas. Orsman, F.I.C., F.C.S.
Date of Analysis— . . . .

Notes.

LANCASHIRE.

Colliery—HAYDOCK, ... Seam, Old Boston Pit.

Old Boston, Little Delf Coal.

Class of Coal— . . . .

Chemical analysis—	Per cent.
Water expelled at 212 degs. Fahr. ..	4·6
Volatile hydrocarbons	30·1
Fixed carbon	63·3
Ash	1·4
Sulphur	0·6
	100·0

Practical results—	
Gas per ton of coal at 60 degs. F., and 30 in. bar.	10,800 cubic feet
Illuminating power of gas in standard candles	16·5 candles
Percentage of coke in coal	64·7 per cent.
Coke per ton of coal	1,449 lb.
Colour of ash	Light brown

The above is a very pure coal, being low in ash and extremely low in sulphur. It should be valuable for chemical and metallurgical purposes. It yields a hard coke.

Analyst—Wm. Jas. Orsman, F.I.C., F.C.S.

Date of Analysis— . . . .

Colliery—HAYDOCK, Seven Feet Seam, Wood Pit.

Wood Pit, Seven Feet Coal.

Class of Coal—House.

Chemical analysis—	Per cent.
Water expelled at 212 degs. Fahr... ..	5·8
Volatile hydrocarbons	33·7
Fixed carbon	58·2
Ash	1·4
Sulphur	0·9
	100·0

Practical results—	
Gas per ton of coal at 60 degs. F., and 30 in. bar.	10,630 cubic feet
Illuminating power of gas in standard candles	16·5 candles
Percentage of coke in coal	59·6 per cent.
Coke per ton of coal	1,334 lb.
Colour of ash	Light brown

The above should be a good house coal. The coke is porous, rather short, but low in sulphur.

Analyst—Wm. Jas. Orsman, F.I.C., F.C.S.

Date of Analysis— . . . .

LANCASHIRE.

Notes.

Colliery—HAYDOCK, Seven Feet Seam, Old Boston Pit.

Old Boston Seven Feet Coal.

Class of Coal— . . . .

Chemical analysis—	Per cent.
Water expelled at 212 degs. Fahr.	5·1
Volatile hydrocarbons	33·2
Fixed carbon	55·7
Ash	4·4
Sulphur	1·6
	100·0

Practical results—

Gas per ton of coal at 60 degs. F. and 30 in. bar.	11,000 cubic feet
Illuminating power of gas in standard candles	17·0 candles
Percentage of coke in coal	60·1 per cent.
Coke per ton of coal	1,046 lb.
Colour of ash	Red grey.

The above coal gives a well-fused but rather brittle coke, and should be good for household and heating purposes.

Analyst—Wm. Jas. Orsman, F.I.C., F.C.S.
Date of Analysis— . . . .

Colliery—HAYDOCK, Nine Feet Seam, Old Boston Pit.

Old Boston Nine Feet Coal.

Class of Coal— . . . .

Chemical analysis—	Per cent.
Water expelled at 212 degs. Fahr.	4·3
Volatile hydrocarbons	29·2
Fixed carbon	58·0
Ash	6·0
Sulphur	2·5
	100·0

Practical results—

Gas per ton of coal at 60 degs. F., and 30 in. bar.	10,600 cubic feet
Illuminating power of gas in standard candles	16·5 candles
Percentage of coke in coal	64 per cent.
Coke per ton of coal	1,433 lb.
Colour of ash	Red grey

Analyst—Wm. Jas. Orsman, F.I.C., F.C.S.
Date of Analysis— . . . .

Notes.

Lancashire.

Colliery—Haydock, ... Seam, Wood Pit.

Florida Coal, Wood Pit.

Class of Coal— . . . .

Chemical analysis—	Per cent.
Water expelled at 212 degs. Fahr.	5·0
Volatile hydrocarbons	35·0
Fixed carbon	57·2
Ash	1·8
Sulphur	1·0
	100·0

Practical results—	
Gas per ton of coal at 60 degs. F., and 30 in. bar	10,900 cubic feet
Illuminating power of gas in standard candles	18·0 candles
Percentage of coke in coal	59·0 per cent.
Coke per ton of coal	1,321 lb.
Colour of ash	Light red grey.

The above is rich in gas of high illuminating power. It should be excellent for heating purposes.

Analyst—Wm. Jas. Orsman, F.I.C., F.C.S.

Date of Analysis— . . . . . .

Colliery—Haydock, ... Seam, Wood Pit.

Parr No. 1 Florida Coal.

Class of Coal— . . . .

Chemical analysis—	Per cent.
Water expelled at 212 degs. Fahr.	5·5
Volatile hydrocarbons	35·2
Fixed carbon	54·4
Ash	4·0
Sulphur	0·9
	100·0

Practical results—	
Gas per ton of coal at 60 degs. F. and 30 in. bar.	13 000 cubic feet
Illuminating power of gas in standard candles	18·0 candles
Percentage of coke in coal	58·4 per cent.
Coke per ton of coal	1,308 lb.
Colour of ash	Grey brown.

The above gives a good yield of high illuminating power. It should be good for household purposes.

Analyst—Wm. Jas. Orsman, F.I.C., F.C.S.

Date of Analysis— . . . .

LANCASHIRE.

Notes.

Colliery—HAYDOCK, ... Seam, Wood Pit.

Old Boston Florida Coal.

Class of Coal— . . . .

Chemical analysis—	Per cent.
Water expelled at 212 degs. Fahr... ..	4·9
Volatile hydrocarbons	34·0
Fixed carbon	57·8
Ash	2·3
Sulphur	1·0
	100·0

Practical results—	
Gas per ton of coal at 60 degs. F., and 30 in. bar.	10,500 cubic feet
Illuminating power of gas in standard candles	18·0 candles
Percentage of coke in coal	60·1 per cent.
Coke per ton of coal	1,346 lb.
Colour of ash	Light red grey

The coal is rich in gas of high illuminating power. It gives a hard well-fused coke, and is valuable for all heating purposes.

Analyst—Wm. Jas. Orsman, F.I.C., F.C.S.

Date of Analysis— . . . .

Colliery—HAYDOCK, Six Feet Seam, Queen Pit.

Queen Pit Wigan Six-feet Coal.

Class of Coal— . . . .

Chemical analysis—	Per cent.
Water expelled at 212 degs. Fahr... ..	4·8
Volatile hydrocarbons	31·9
Fixed carbon	58·4
Ash	3·8
Sulphur	1·1
	100·0

Practical results—	
Gas per ton of coal at 60 degs. F., and 30 in. bar.	12,000 cubic feet
Illuminating power of gas in standard candles	17·0 candles
Percentage of coke in coal	62·2 per cent.
Coke per ton of coal	1,392 lb.
Colour of ash	Brown

The above is a slow-burning coal and suitable for steam-raising purposes. At a high temperature it gives a large yield of gas, but the coke is powdery.

Analyst—Wm. Jas. Orsman, F.I.C., F.C.S.

Date of Analysis— . . . .

Notes.

LANCASHIRE.

Colliery—PARR, ... Seam, Parr No. 4 Pit.

Rushy Park Coal, Parr No. 4.

Class of Coal—Gas and Steam.

Chemical analysis—	Per cent.
Water expelled at 212 degs. Fahr... ..	1·8
Volatile hydrocarbons	38·9
Fixed carbon	57·1
Ash	1·4
Sulphur	0·8
	100·0

Practical results—	
Gas per ton of coal at 60 degs. F. and 30 in. bar.	11,900 cubic feet
Illuminating power of gas in standard candles	18·0 candles
Percentage of coke in coal	58·8 per cent.
Coke per ton of coal	1,317 lb.
Colour of ash	Buff

The above is an excellent coal for gas-making and steam-raising purposes. The coke is excellent and very hard. Sulphur is low.

Analyst—Wm. Jas. Orsman, F.I.C., F.C.S.

Date of Analysis— . . . . .

Colliery—PARR, ... Seam, Parr No. 4 Pit.

Parr No. 4, Little Delf Coal.

Class of Coal— . . .

Chemical analysis—	Per cent.
Water expelled at 212 degs. Fahr... ..	1·5
Volatile hydrocarbons	35·4
Fixed carbon	61·0
Ash	1·3
Sulphur	0·8
	100·0

Practical results—	
Gas per ton of coal at 60 degs. F., and 30 in. bar.	10,900 cubic feet
Illuminating power of gas in standard candles	16·5 candles
Percentage of coke in coal	62·3 per cent.
Coke per ton of coal	1,395 lb,
Colour of ash	Light brown

The above yields a good hard, well-fused coke, very low in ash and sulphur. This should be excellent for chemical works and metallurgical purposes.

Analyst—Wm. Jas. Orsman, F.I.C., F.C.S.

Date of Analysis— . . . .

Notes.

LANCASHIRE.

Colliery—PARR, Six Feet Seam, Parr No. 2 Pit.

Wigan Six-feet Coal, Parr No. 2.

Class of Coal— . . . .

Chemical analysis—	Per cent.
Water expelled at 212 degs. Fahr... ..	4·6
Volatile hydrocarbons	30·7
Fixed carbon	60·4
Ash	3·2
Sulphur	1·1
	100·0

Practical results—	
Gas per ton of coal at 60 degs. F., and 30 in. bar.	10,000 cubic feet
Illuminating power of gas in standard candles	16·0 candles
Percentage of coke in coal	63·6 per cent.
Coke per ton of coal	1,424 lb.
Colour of ash	Light red grey

The above is adapted for household purposes. The coke is brittle and shaly.

Analyst—Wm. Jas. Orsman F.I.C., F.C.S.
Date of Analysis— . . . . . .

EXECUTORS OF COLONEL HARGREAVES,

Burnley.

Colliery—HAPTON VALLEY, Mountain Mine Seam, Hapton Valley Pit.
Shipping Port—Liverpool.
Rail—Lancashire and Yorkshire, Burnley Station.
Canal—Leeds and Liverpool.

Mountain Mine Coal.

Class of Coal—Coking and Steam.

	Per cent.
Sulphur	0·41
Ash	1·14
Moisture	1·71
Volatile matter	28·33
Coke	71·67
	100·00

Analyst—Edward Riley.
Date of Analysis—January 31, 1905.

Notes.

LANCASHIRE.

Collieries—BURNLEY, ... Seam, ... Pit.

Arley Mine Coal.

Class of Coal—Gas.

Test made with 5 tons, in the Burnley Corporation experimental plant:—

Gas made per ton of coal, corrected to 60 degs. Fahr. and 30 in. bar.	10,480 cubic feet
Illuminating power of the gas, corrected to 5 cubic feet per hour and for temperature and pressure	17·18 candles
Coke made per ton of coal	13·33 cwt.
Quality of coke	Good
*Ammonium sulphate made per ton of coal	25 lb.
*Tar made per ton of coal	148·5 lb.

* These results are obtained from a year's working with this coal at the Burnley Corporation Gasworks.

Analysis of coal—	Per cent.
Moisture	1·14
Volatile matters	36·26
Ash	3·63
Fixed carbon	58·97
	100·00
Sulphur (contained in the above)	2·26

Analysts—Raymond Ross, F.I.C., F.C.S., and Jno. P. Leather, F.C.S

Date of Analysis—July 9, 1903.

GEORGE HARGREAVES AND CO.,

The Collieries, Accrington.

Colliery—ACCRINGTON, ... Seam, Huncoat Pit.

Shipping Ports—Fleetwood and Manchester.

Rail—Lancashire and Yorkshire, Accrington Station.

Canal—*Nil.*

Lower Mountain Mine Coal.

Class of Coal—Coking and Steam.

	Per cent.
Volatile matter	29·59
Coke	70·41
	100·00
Sulphur	0·325
Ash	5·900
Moisture	1·100

Analyst—Edward Riley.

Date of Analysis—October 17, 1904.

LANCASHIRE.

Notes.

HINDLEY FIELD COAL COMPANY LIMITED,

The Grange, Hindley, near Wigan.

Colliery—HINDLEY FIELD, ... Seam,
. . . . Pit.

Shipping Ports—Garston, Runcorn, Preston, Liverpool, Partington.
Rail—Station *nil.*
Canal—*Nil.*

Long Arley Mine Coal.

Class of Coal— . . . .

A sample of this coal representing the entire product of the seam, gave on examination the following results :—

MINERALOGICAL CHARACTERS.—Colour, black with considerable lustre and brownish-black streak. Fracture, partly defined by intermittent laminæ of vegetable charcoal and therefore irregular. Cross-fracture, crystalline and resinoid, with very thin deposits of carbonate of lime in the natural partings. Moderately cohesive, compact and non-porous. On the fire it intumesces and agglomerates. Ash, dark brown, and chiefly ferric oxide. Thickness of seam, 4 ft.; mean specific gravity, 1,273 (water, 1,000). Weight of 1 cubic foot, 79·56 lb.

Chemical analysis—		Per cent.
Volatile matters (containing 0·22 of sulphur)		33·55
Coke, consisting of—		
Carbon	61·70	
Sulphur	0·13	
Ash	1·92	
		63·75
Water expelled at 212 degs. Fahr. ..		2·70
		100·00

Practical results (gaseous products)—	
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar.	11,618 cubic feet
Gas from 1 cubic foot of the coal	412·64 cubic feet
Specific gravity of the gas	486 (air 1,000)
Hydrocarbons absorbed by bromine ..	6·20 per cent.
Durability of 1 cubic foot by 5 in. jet flame	44 mins. 40 secs.
Value of 1 cubic foot of gas..	462·24 grains sperm
Value of gas from 1 ton of coal	766·90 lb. sperm
Illuminating power of gas in standard candles	19·26 candles
Sulphuretted hydrogen (H_2S) in foul gas	0·50 per cent.
Carbonic acid (CO_2) in foul gas	1·50 per cent.
Carbonic oxide (CO) in foul gas	4·00 per cent.
Sulphur eliminated with volatile products	4·93 lb.

Notes.

LANCASHIRE.

Long Arley Mine Coal—*cont.*

Liquid products—

Tar per ton of coal	14·20 gallons
Ammoniacal liquor, per ton of coal ..	11·60 gallons
Strength of ammoniacal liquor	3·80 degs. Twadd.
Hygrometric water, per ton of coal ..	6·04 gallons
Aqueous absorbent capacity of coal (determined by complete saturation) ..	4·50 per cent.

Solid products—

Coke per ton of coal	1,428·00 lb.
Carbon in the coke	97·00 per cent.
Ash in the coke	3·00 per cent.
Sulphur in coke per ton of coal	2·91 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	13·43 lb.

This is an uncommonly rich and valuable coking coal. It requires a moderate heat for distillation, yields a large volume of gas of high photogenic power, and affords 12¾ cwt. of coke of the purest class. It possesses also a very moderate aqueous absorbent capacity, and contains a very small amount of sulphur.

Compared with the Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas per ton, and 1,535·5 lb. of sperm, and having regard to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 60·63.

Analyst—George R. Hislop, F.C.S., F.R.S.S.A., etc.

Date of Analysis—May 15, 1880.

Arley Yard Coal.

Class of Coal— . . . .

A sample of this coal, representing the entire product of the seam, gave on examination the following results :—

MINERALOGICAL CHARACTERS.—Colour, black with considerable lustre and brownish-black streak. Fracture, small semi-crystalline and scalariform, with intermittent laminæ of vegetable charcoal. Cross-fracture, partly angular, curly, and inclining to resinoid, the natural partings exhibiting shining resinoid planes, and deposits of carbonate of lime, but without trace of pyrites. Very compact and moderately friable. On the fire it intumesces and agglomerates. Ash, dark brown, and chiefly ferric oxide. Thickness of seam, 3 ft.; mean specific gravity 1,280 (water 1,000); weight of 1 cubic foot, 80 lb.

Notes.

LANCASHIRE.

Chemical analysis—			Per cent.
Volatile matters (containing 0·45 of sulphur)			33·57
Coke consisting of—			
Carbon		59·09	
Sulphur		0·23	
Ash		3·01	
			62·33
Water expelled at 212 degs. Fahr... ..			4·10
			100·00
Practical results (gaseous products)—			
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar.			10,864 cubic feet.
Gas from 1 cubic foot of the coal			388·0 cubic feet
Specific gravity of the gas			478 (air 1,000)
Hydrocarbons absorbed by bromine ..			5·10 per cent.
Durability of 1 cubic foot by 5 in. jet flame			40 mins. 10 secs.
Value of 1 cubic foot of gas			399·84 grains sperm
Value of gas from 1 ton of coal			620·55 lb. sperm
Illuminating power of gas in standard candles (per London Argand and 7 in. chimney)			16·66 candles
Sulphuretted hydrogen (H_2S) in foul gas			1·33 per cent.
Carbonic acid (CO_2) in foul gas			2·25 per cent.
Carbonic oxide (CO) in foul gas			6·25 per cent.
Sulphur eliminated with volatile products			10·09 lb.
Liquid products—			
Tar per ton of coal			14·21 gallons
Ammoniacal liquor per ton of coal ..			17·82 gallons
Strength of ammoniacal liquor			3·25 degs. Twadd.
Hygrometric water per ton of coal ..			9·18 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)			5·37 per cent.
Solid products—			
Coke per ton of coal			1,396·19 lb.
Carbon in the coke			95·20 per cent.
Ash in the coke			4·80 per cent.
Sulphur in coke per ton of coal			5·14 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)..			13·04 lb.

This is an excellent gas and coking coal. It parts with its volatile products within the average time and at a moderate heat, contains a moderate amount of both sulphur and water, and affords 12·46 cwt. of first-class coke.

Compared with the Nitshill and Lesmahagow Coal Company's cannel coal represented by 100 (calculated on the basis of a production

Notes.

LANCASHIRE.

Arley Yard Coal—*cont.*

of 13,000 cubic feet of gas per ton, and 1,335·5 lb. of sperm, and having regard also to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 49·43.

Analyst—George R. Hislop, F.C.S., F.R.S.S.A., etc.

Date of Analysis—May 15, 1882.

A. KNOWLES AND SONS LIMITED,

Pendlebury, near Manchester.

Colliery—PENDLETON, ... Seam, Rams Mine Pit.

Shipping Ports—Manchester, Garston, Runcorn, Preston.

Rail—L. and N. W. and Lancs. and Yorks.; Private Sidings, Pendleton, Lancs. and Yorks.; Agecroft, Bundle Head Goods Station, Clifton Hall and Pendlebury, L. and N. W.; Molyneux Junction, Lancs. and Yorks.; Patricroft, L. and N. W.

Canal—Manchester, Bolton and Bury.

Rams Mine Seconds.

Class of Coal—Gas, Steam, Manufacturing, House.

I hereby certify that I have made a most careful analysis, technical test and examination, with the understated results, of the sample of coal marked "Rams Mine Seconds from Pendleton Colliery."

Chemical analysis—	
Specific gravity	1·27
Weight per cubic foot	79·49 lb.
Total sulphur	0·43 per cent.
Total ash	4·02 per cent.
Total volatile matter	48·43 per cent.
Water	1·00 per cent.
Total volatile and combustible matter	95·93 per cent.
Technical test and examination—	
Gas per ton	10,016 cubic feet
Illuminating power of gas	17 standard candles
Coke per ton	1,460 lb.
Tar per ton	101 lb.
Ammoniacal liquor per ton	307 lb.

The sulphur is present in small quantity, while the percentage of ash is low and normal. The coke is of a thoroughly satisfactory quality,

Notes.

clean, and stands a good burden. The tar is also of a thoroughly satisfactory and normal quality. The ammoniacal liquor is calculated at 5 degs. Twaddell, and is therefore equal to 307 lb. of "10 oz. liquor."

From the foregoing tabulated results of my analysis and testing, I am of decided opinion that the coal in question is a good gas coal, and thoroughly suitable for gas manufacturing and coking purposes.

Analyst—W. Hepworth Collins, F.C.S., F.G.S., F.R.M.S., etc.
Date of Analysis—September 15, 1894.

Colliery—AGECROFT, ... Seam, Dow Mine Pit.

Dow Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

I hereby certify that I have made a most careful analysis, technical test, and examination, with the understated results, of a sample of coal marked "Dow Coal from Agecroft Colliery."

Chemical analysis—

Specific gravity	1·28
Weight per cubic foot	80 lb.
Total sulphur	0·40 per cent.
Total ash	3·17 per cent.
Volatile matter	52·00 per cent.
Water	1·05 per cent.
Total volatile and combustible matter ..	96·83 per cent.

Technical test and examination—

Gas per ton	10,950 cubic feet
Illuminating power of gas	17 standard candles
Coke per ton	1,466 lb.
Tar per ton	107 lb.
Ammoniacal liquor per ton	363 lb.

The coke is particularly clean, stands a good burden, and is a thoroughly satisfactory quality. The sulphur compounds and the ash are present in very small quantity indeed. The tar is of a thoroughly good quality also. The ammoniacal liquor is calculated at 5 degs. Twaddell, and is therefore equal to 363 lb. of "10 oz. liquor."

From the foregoing tabulated results of my analyses and testings, I am of decided opinion that the coal in question is a good gas coal, eminently suited for gas manufacturing, and quite equal and in some cases superior to many of the well-known gas coals at present in large use.

Analyst—W. Hepworth Collins, F.C.S., F.G.S., F.R.M.S., etc.
Date of Analysis—August 21, 1894.

Notes.

LANCASHIRE.

Colliery—CLIFTON HALL, ... Seam, Trencherbone Mine Pit.

Trencherbone Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

I hereby certify that I have made a most careful analysis, technical test, and examination, with the understated results, of a sample of coal marked "Trencherbone Coal from Clifton Hall Colliery."

Specific gravity	1·28
Weight per cubic foot	80 lb.
Total sulphur	0·37 per cent.
Total ash	3·01 per cent.
Volatile matter	52·16 per cent.
Water	1·07 per cent.
Total volatile and combustible matter ..	96·99 per cent.

Technical test and examination—

Gas per ton	10,967 cubic feet
Illuminating power of gas	17 standard candles
Coke per ton	1,476 lb.
Tar per ton	110 lb.
Ammoniacal liquor per ton	365 lb.

The sulphur compounds and ash are only present in very small quantity indeed. The coke is particularly clean, stands a good burden, and is of a thoroughly satisfactory quality. The tar is of a thoroughly good quality also. The ammoniacal liquor is calculated at 5 degs. Twaddell, and is therefore equal to 365 lb of "10 oz. liquor."

From the foregoing tabulated results of my analyses and testings, I am of decided opinion that the coal in question is a good gas coal, eminently suitable for gas manufacturing, and quite equal and in some instances superior to many of the well-known gas coals at present so largely used.

Analyst—W. Hepworth Collins, F.C.S., F.G.S., F.R.M.S., etc.

Date of Analysis—August 21, 1894.

LANCASHIRE.

Notes.

MOSS HALL COAL COMPANY LIMITED,

Wigan.

Colliery— . . . . Seam, ... Pit.
Shipping Port— . . . .
Rail— . . . . Station.
Canal— . . . .

Moss Hall Gas Coal.

Class of Coal—Gas.

Yield of gas per ton of coal	10,800 cubic feet
Yield of coke per ton of coal	1,444 lb.
Ash in coke	2·32 per cent.
Specific gravity of the coal	1,266
Condensation by bromine	5 per cent.
Illuminating power	16·75 std. candles
Value of 1 cubic foot	402 grains sperm
Value of gas per ton of coal	620·23 lb. sperm
Sulphur	1·183 per cent.

Analyst— . . . . . .
Date of Analysis— . . . . . .

P. W. PICKUP LIMITED,

Rishton, Blackburn.

Colliery—RISHTON, ... Seam, Rishton Pit.
Shipping Port—Preston.
Rail—L. and Y., Rishton Station.
Canal—Leeds and Liverpool.

Rishton Lower Mountain Mine Coal.

Class of Coal—Steam, Coking, Manufacturing and House.

A sample of this coal, representing the entire product of the seam, gave on examination the following results :—

		Per cent.
Proximate analysis—		
Volatile matters (containing 0·68 of sulphur)		20·72
Coke, consisting of—		
Carbon	73·73	
Sulphur	0·18	
Ash	3·24	
		77·15
Water expelled at 212 degs. Fahr... ..		2·13
		100·00

Notes.

LANCASHIRE.

Rishton Lower Mountain Mine Coal—*cont.*

Ultimate analysis—

	Per cent.
Carbon	81·68
Hydrogen	4·99
Oxygen	5·81
Nitrogen	1·86
Sulphur	0·45
Ash	2·86
Moisture	2·35
	100·00

Calorific power:—Pounds of water evaporated from 212 degs. Fahr. by 1 lb. of the coal as determined by Thomson's calorimeter = 15 lb.

Analyst—H. Dunford Smith.

Date of Analysis—December, 1901.

J. SPEAKMAN AND SONS,

Leigh, Lancashire.

Colliery—BEDFORD, ... Seam, Bedford Pit.

Shipping Ports—All Lancashire Ports.

Rail—L. and N. W., Speakman Sidings, Leigh and Bedford Station.

Canal—*Nil.*

Bedford Gas Cobbles.

Class of Coal—Gas.

		Per cent.
Volatile matter (containing 0·58 per cent. of sulphur)		35·37
Coke, consisting of		
Carbon	55·88	
Sulphur	0·27	
Ash	3·08	
		59·23
Water expelled at 212 degs. Fahr... ..		5·40
		100·00

Gaseous products—

Gas per ton of coal at 60 degs. F. and 30 in. bar.	12,225 cubic feet
Gas from 1 cubic foot of the coal	423·16 cubic feet
Specific gravity of the gas	505 (air 1,000)
Hydrocarbons absorbed by bromine	6·50 per cent.
Durability of 1 cubic foot by 5 in. jet flame ..	46 min. 48 sec.
Value of 1 cubic foot of gas	507·12 grains sperm
Value of gas from 1 ton of coal	860·49 lb. sperm
Illuminating power of gas	20·53 candles
Sulphuretted hydrogen (H_2S) in foul gas ..	1·50 per cent.
Carbonic acid (CO_2) in foul gas	3·33 per cent.
Carbonic oxide (CO) in foul gas	7·00 per cent.
Sulphur eliminated with volatile products ..	13·00 lb.

Notes.

LANCASHIRE.

Liquid products—	
Tar per ton of coal	13·50 gallons
Ammoniacal liquor per ton of coal	21·60 gallons
Strength of ammoniacal liquor	2·70 degs. Twadd.
Hygrometric water per ton of coal	12·09 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	7·43 per cent.
Solid products—	
Coke per ton of coal	1,326·75 lb.
Carbon in the coke	94·80 per cent.
Ash in coke	5·20 per cent.
Sulphur in coke per ton of coal..	6·04 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	13·02 lb.

Analyst—Geo. R. Hislop, F.C.S., etc.

Date of Analysis—November 12, 1903.

Rams Gas Coal.

Class of Coal—Gas.

		Per cent.
Volatile matters (containing 0·51 of sulphur)		34·84
Coke consisting of—	Per cent.	
Carbon	56·84	
Sulphur	0·23	
Ash	2·88	
		59·95
Water expelled at 212 degs. Fahr.		5·21
		100·00

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar.	12,055 cubic feet
Gas from 1 cubic foot of the coal	114·39 cubic feet
Specific gravity of the gas	490 (air 1,000)
Hydrocarbons absorbed by bromine ..	6·25 per cent.
Durability of 1 cubic foot by 5 in. jet flame	45 min. 8 sec.
Value of 1 cubic foot of gas	472·32 grains sperm
Illuminating power of gas in standard candles	19·68 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·33 per cent.
Carbonic acid (CO_2) in foul gas	3·50 per cent.
Carbonic oxide (CO) in foul gas	7·25 per cent.
Sulphur eliminated with volatile products	11·59 lb.

Notes.

LANCASHIRE.

Rams Gas Coal—*cont.*

Liquid products—

Tar per ton of coal	13·25 gallons
Ammoniacal liquor per ton of coal ..	21·20 gallons
Strength of ammoniacal liquor	2·75 degs. Twadd.
Hygrometric water per ton of coal ..	11·67 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	7·20 per cent.

Solid products—

Coke per ton of coal	1,342·88 lb.
Carbon in the coke	95·00 per cent.
Ash in the coke	4·80 per cent.
Sulphur in coke per ton of coal	4·98 per cent.
Heating power of 1 lb. of coke (water from boiling point into steam)	13·08 per cent.

Analyst—Geo. R. Hislop, F.C.S., etc.

Date of Analysis—November 12, 1903.

WIGAN COAL AND IRON COMPANY LIMITED,

Wigan.

Colliery— . . . . Haigh Yard Seam, ... Pit.

Shipping Ports—All Mersey Ports, and Preston, Fleetwood and Glasson Dock.

Rail—L. and N. W., L. and Y., and Great Central, Wigan and Hindley Stations.

Canals—Leeds and Liverpool, Bridgwater.

Haigh Yard Coal.

Class of Coal—Steam, Manufacturing, House.

Specific gravity	1·28
Weight per cubic foot	80·0 lb.
Ash	1·7 per cent.
Volatile hydrocarbons	34·0 per cent.
Fixed carbon	63·83 per cent.
Coke produced	66·0 per cent.
Sulphur	0·95 per cent.
Ash in coke	2·5 per cent.
Calorific value	7,458 heat units
Water converted into steam by 1 lb. of fuel	13·85 lb.

Analyst—T. H. Byrom.

Date of Analysis— . . . . , 1905.

LANCASHIRE.

Notes.

Colliery— . . . . . . King Seam, ... Pit.

King Coal.

Class of Coal—Manufacturing, House.

Specific gravity	1·28
Weight per cubic foot	80·0 lb.
Ash	3·1 per cent.
Sulphur	2·35 per cent.
Volatile hydrocarbons	35·5 per cent.
Fixed carbon	60·23 per cent.
Coke produced	64·5 per cent.
Ash in coke	4·8 per cent.
Calorific value	7,392 heat units
Water converted into steam by 1 lb. of fuel	13·75 lb.

Analyst—T. H. Byrom.

Date of Analysis— . . . , 1905.

Colliery— . . . . . . Seven-feet Seam, ... Pit.

Hard Seven-feet Coal.

Class of Coal—Steam, Manufacturing, House.

Specific gravity	1·26
Weight per cubic foot	78·75 lb.
Ash	1·9 per cent.
Sulphur	0·64 per cent.
Volatile hydrocarbons	39·4 per cent.
Fixed carbon	58·1 per cent.
Coke produced	60·6 per cent.
Ash in coke	3·1 per cent.
Calorific value	7,480 heat units
Water converted into steam per 1 lb. fuel	13·9 lb.

Analyst—T. H. Byrom.

Date of Analysis— . . . , 1905.

Notes.

LANCASHIRE.

Colliery— . . . . Crombôuke Seam, ... Pit.

Crombouke Coal.

Class of Coal—Steam, Manufacturing, House.

Specific gravity	1·27 per cent.
Weight per cubic foot	79·37 lb.
Ash	2·3 per cent.
Sulphur	1·37 per cent.
Volatile hydrocarbons	41·0 per cent.
Fixed carbon	55·4 per cent.
Coke produced	59·0 per cent.
Ash in coke	3·9 per cent.
Calorific value	7,370 heat units
Water converted into steam per 1 lb. fuel	13·7 lb.

Analyst—T. H. Byrom.

Date of Analysis—1905.

Colliery— . . . . Yard Seam, ... Pit.

Long Yard Coal.

Class of Coal—Steam, Manufacturing, House.

Specific gravity	1·26
Weight per cubic foot	78·75 lb.
Ash	2·9 per cent.
Sulphur	1·42 per cent.
Volatile hydrocarbons	37·4 per cent.
Fixed carbon	58·7 per cent.
Coke produced	62·6 per cent.
Ash in coke	4·6 per cent.
Calorific value	7,370 heat units
Water converted into steam per 1 lb. fuel	13·7 lb.

Analyst—T. H. Byrom.

Date of Analysis—1905.

Notes.

Lancashire.

Colliery— . . . . Arley Seam . . . . Pit.

Best Coal.

Class of Coal—Gas and House.

Specific gravity	1·26
Weight per cubic foot	78·75 lb.
Ash	2·9 per cent.
Sulphur	1·82 per cent.
Volatile hydrocarbons	36·3 per cent.
Fixed carbon	58·8 per cent.
Coke produced	63·7 per cent.
Ash in coke	4·5 per cent.
Calorific value	7,590 heat units
Water converted into steam per 1 lb. fuel	14·1 lb.

Analyst—T. H. Byrom.

Date of Analysis—1905.

Notes.

LEICESTER.

THE NAILSTONE COLLIERY COMPANY,

Nailstone Colliery, near Leicester.

Colliery—NAILSTONE, Upper Main Seam, No. 1 Pit.
Shipping Ports—Hull, Grimsby, Lynn, Goole, Garston.
Rail—Midland and L. and N. W., Bagworth (Mid.), Hugglescote (L. and N. W.) Station.
Canal—By transhipment from Leicester.

Upper Main Seam Steam Coal.

Class of Coal—Steam.

	Per cent.
Carbon	70·42
Hydrogen	4·95
Nitrogen	1·35
Oxygen	15·77
Sulphur	1·44
Ash	6·07
	100·00
Water	13·22
Volatile or gaseous constituents ..	30·99
Percentage yield of coke	50·52
Ash	5·27
	100·00

Sulphur	1·25 per cent.
Calorific equivalent	7,315 heat units
British thermal units	13,170 B.T.U.
Heat equivalent in pounds for feed-water at 60 degs. raised to 160 lb. pressure—	
Dried coal	10·3 lb.
13 per cent. moisture	9·0 lb.

Analyst—Matthew J. Cannon, F.C.S.
Date of Analysis—July 1, 1905.

LEICESTER

Notes.

Colliery—NAILSTONE, Deep Main Seam, No. 2 Pit.

Best House Coal.

Class of Coal—Steam, Manufacturing, House.

	Per cent.
Carbon	74·91
Hydrogen	4·98
Nitrogen	1·22
Oxygen	14·99
Sulphur	0·86
Ash	3·04
	100·00

	Per cent.
Water	13·20
Volatile or gaseous constituents..	30·00
Percentage yield of coke	54·16
Ash	2·64
	100·00

Sulphur	0·75 per cent.
Calorific equivalent	7,700 heat units
British thermal units	13,860 B.T.U.

Analyst—Matthew J. Cannon, F.C.S.
Date of Analysis—July 1, 1905.

Notes.

MONMOUTH.

BLINDELL AND WAKEFIELD,

Exchange Buildings, Cardiff.

Colliery—JOHN BLINDELL'S BLACK VEIN, ... Seam, Glyn Pits.

Shipping Ports—Newport, Cardiff, Penarth, Barry.

Rail—Great Western, Crane Street, Pontypool, Station.

Canal—*Nil.*

John Blindell's Black Vein Steam Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

	Per cent.
Moisture	2·00
Ash	2·48
Fixed carbon	60·39
Volatile matter	35·13
	100·00
Sulphur	1·28
Coke	62·87

The evaporative power as given by Thomson's calorimeter is 1 lb. of coal equals 14·07 lb. of water at 100 C.

Analyst—George R. Thompson.

Date of Analysis—March, 1900.

EBBW VALE STEEL, IRON AND COAL COMPANY LIMITED,

Ebbw Vale.

Colliery—ABERCARN, ... Seam, Prince of Wales Pit.

Shipping Ports—Newport, Cardiff.

Rail—Great Western, Abercarn Colliery Station.

Canal—*Nil.*

Abercarn Coal.

Class of Coal— . . . . . .

Yield of gas per ton of coal..	12,300 cubic feet
Illuminating power	15·97 candles
Value of 1 cubic foot of gas	383 grains sperm
Value of gas per ton of coal	673 lb. sperm

Analyst— . . . . . .

Date of Analysis— . . . . . .

MONMOUTH. | *Notes.*

Colliery—GRAIG FAWR, ... Seam, Graig Fawr Pit.
Shipping Ports—Newport, Cardiff.
Rail—Great Western, Graig Fawr Colliery Station.
Canal— . . . .

Ebbw Vale Red Ash Coal.

Class of Coal—Gas, Manufacturing, House.

Yield of gas per ton of coal	11,800 cubic feet
Illuminating power	15 standard candles
Value of 1 cubic foot of gas..	360 grains sperm
Value of gas per ton of coal	607 lb. sperm
Specific gravity of the coal	1,274
Condensation by bromine	5 per cent.
Gas purified by 1 cwt. lime..	14,000 cubic feet
Yield of coke per ton of coal	1,466 lb.
Ash in coke	3·35 per cent.

Analyst— . . . .
Date of Analysis— . . . .

Colliery—EBBW VALE, ... Seam, Ebbw Vale Pit.
Shipping Ports—Newport, Cardiff.
Rail—Great Western, and L. and N. W., Ebbw Vale Station.
Canal— . . . .

Ebbw Vale Steam Coal.

Class of Coal—Steam, Smokeless Steam, Manufacturing, House.

	Per cent.
Carbon	89·470
Hydrogen	5·480
Nitrogen	1·112
Oxygen	2·687
Sulphur	0·621
Ash	0·630
	100·000

Analyst—Edward Riley, F.C.S.
Date of Analysis—October 28, 1896.

Notes.

MONMOUTH.

ELLED COAL COMPANY,

Abercarn.

Colliery— . . . . Seam, Quarry Pit.

Shipping Ports—Newport, Cardiff.

Rail—Great Western, Abercarn Station.

Canal— . . . .

Red Ash Coal.

Class of Coal—Steam, Manufacturing, House.

	Per cent.
Red ash	5·200
Sulphur	2·243
Volatile matter	29·917
Fixed carbon	62·640
	100·000

Water evaporated by 1 lb. of coal, 14 lb. ..

Analyst—John Parry.

Date of Analysis—1905.

ELLED COLLIERY COMPANY LIMITED,

14, West Bute Street, Dock, Cardiff.

Colliery—ELLED, PONTNEWYNYDD, Elled Seam, Elled Pit.

Shipping Ports—Newport, Cardiff, Barry.

Rail—Great Western, Pontnewynydd Station.

Canal—*Nil.*

Elled Coal.

Class of Coal—House, Steam, Gas.

	Per cent.
Volatile matter	31·30
Ash	4·52
Sulphur	1·77
Coke	68·00

Colour of ash pinky grey. The coke metallic in appearance, of good hard quality.

Yield of gas per ton.. ..	(corrected)	10,542 cubic feet
Illuminating power of gas ..	.. ..	17·95 candles
Value of coal per ton	.. .. ..	37,845 candles
Ditto in terms of sperm	.. .. ..	648·77 lb.
Yield of coke.. ..	.. .. ..	13·4 cwt. per ton
Yield of ash	.. .. ..	6·71 per cent.

MONMOUTH.

Notes.

It is a very good coal for house purposes and for all purposes in which a bituminous coal is required. As a gas coal it is exceedingly well adapted, yielding as it does a large quantity of gas of good and most suitable illuminating power. It is a coal which is capable of yielding gas of ample illuminating power without the addition of cannel, and at the same time gives a coke of good quality, such as is not usually obtained from coals which furnish gas in like quality and of a similar lighting power.

Analyst—J. W. Thomas.

Date of Analysis— . . . . . .

NEWPORT ABERCARN BLACK VEIN STEAM COAL COMPANY LIMITED,

Newbridge.

Colliery—ABERCARN, ... Seam, Celynen Pit.

Shipping Ports—Newport, Cardiff, Penarth, Barry.

Rail—Great Western, Abercarn Station.

Canal— . . . . . .

Newport-Abercarn Black Vein Steam Coal.

Class of Coal—Steam.

	Per cent.
Carbon	84·91
Hydrogen	5·33
Oxygen	3·27
Nitrogen	1·61
Sulphur	0·57
Ash	4·31
	100·00

	Per cent.
Volatile matter	25·84
Coke	74·16
	100·00

Calorific value as determined by Thompson's calorimeter:—

Calories	8,030
Evaporative power	14·95 lb.
Moisture	0·80 per cent.

Analyst—Edward Riley, F.I.C., F.C.S.

Date of Analysis—February 16, 1903.

Notes.

MONMOUTH.

PARTRIDGE, JONES AND CO. LIMITED,

93, Dock Street, Newport (Mon.)

Colliery—LLANERCH, Meadow Vein Seam, ... Pit.

Shipping Ports—Newport, Cardiff, Barry.

Rail—Great Western, Pontnewynydd Station.

Canal— . . . .

Llanerch Gas Coal.

Class of Coal—Gas.

	Per cent.
Large coal—	
Volatile matter	34·70*
Ash	2·77
Fixed carbon	62·53
	100·00

* Including water 1·04 per cent.

Total sulphur	0·82
Coke	65·30
Coke—	
Ash	4·24
Sulphur	0·73
Fixed carbon	95·03
	100·00

Yield of coke per 1 ton of the coal, 13 cwt. 0 qr. 7 lb. This coke is a fine hard bright coke, remarkably free from sulphur, and well adapted for household purposes. Upon actual trial, the sample yielded at standard pressure and temperature 9,885 cubic feet of purified gas of illuminating power of 14½ candles, as determined by London Argand. The crude gas is very free from all sulphur compounds other than sulphuretted hydrogen.

Analyst—George R. Thompson.

Date of Analysis—May 15, 1901.

Notes.

Monmouth.

Colliery—Blaenserchan, Black Vein Seam, ... Pit.

Mynydd Black Vein Steam Coal.

Class of Coal—Steam.

Large coal—	Per cent.
Carbon	82·91
Hydrogen	4·89
Oxygen	5·93
Nitrogen	1·00
Ash	3·12
Sulphur	1·11
Moisture	1·04
	100·00

The value of the coal in calories is 8,154, with a theoretical evaporative power of nearly 15·2 lb. of water at 100 degs. Cent. per 1 lb. of the coal.

Analyst—George R. Thompson.

Date of Analysis—May 15, 1901.

Colliery—Llanhilleth, Black Vein Seam, ... Pit.

Shipping Ports—Newport, Cardiff, Barry.

Rail—Great Western, Llanhilleth Station.

Canal— . . . . . .

Western Valley Black Vein Steam Coal.

Class of Coal—Steam.

Large coal—	Per cent.
Carbon	83·64
Hydrogen	4·59
Oxygen	7·01
Nitrogen	1·06
Ash	2·23
Sulphur	0·71
Moisture	0·76
	100·00

The value of the coal in calories is 8,058, with a theoretical evaporative power of 15·0 lb. of water at 100 degs. Cent. per 1 lb. of the coal.

Analyst—George R. Thompson.

Date of Analysis—May 15, 1901.

Notes.

MONMOUTH.

JAS. RICHARDS AND CO.,

Dowlais Chambers, Cardiff.

Colliery—ARGOED (Mon.), Mynyddislwyn Seam, Two Levels Pit.

Shipping Ports—Cardiff, Newport.

Rail—L. and N. W., Argoed Station, Monmouthshire.

Canal—*Nil.*

Argoed Red Ash Coal.

Class of Coal—Highly bituminous coal, suitable for Gas, Manufacturing, House, Coking.

	Per cent.
Ash	3·03
Volatile matter	32·50
Fixed carbon	64·47
	100·00

Moisture	1·10 per cent.
Coke (=13½ cwt. per ton of coal) ..	67·50 per cent.
Sulphur	1·42 per cent.
Phosphorus	0·01 per cent.
Quantity of gas per ton of coal	10,221 cubic feet
Illuminating power	16·05 std. candles
Specific gravity	1·281

Analyst—D. N. Roberts.

Date of Analysis—May, 1903.

T. F. SALT AND CO. LIMITED,

Gwentland House, Oak Street, Abertillery.

Colliery—RHIW, Colborn Tillery Seam, ... Pit.

Shipping Port—Newport.

Rail—Tin Works Siding, Abertillery, Great Western Railway.

Canal— . . . .

Small Coal.

Class of Coal—House, Gas and Smith's Coal.

	Per cent.
Moisture	2·13
Ash	9·70
Volatile matter	31·90
Fixed carbon	56·27
	100·00

Sulphur	1·63 per cent.
Coke	65·97 per cent.

MONMOUTH.

Notes.

The coke produced from this coal is of capital quality, being hard and bright; the yield of dry coke per 1 ton of the coal is 13 cwt. 21 lb.

Upon actual trial the sample yielded 8,858 cubic feet of purified gas at standard pressure and temperature, of illuminating power—13·65 standard candles as determined by London Argand.

This is the net amount, *i.e.*, the total yield, less 12½ per cent. from ordinary laboratory test, but it very closely corresponds to the commercial test.

The sulphur compounds produced upon carbonisation are rather in excess of the ordinary, but sulphuretted hydrogen is the chief, and as such is easily removed in the purifiers.

Analyst—George R. Thompson.

Date of Analysis—March 27, 1906.

TIRPENTWYS BLACK VEIN STEAM COAL AND COKE COMPANY LIMITED,

Pontypool.

Colliery—TIRPENTWYS, Black Vein, Three-quarter, and Big Vein Seams, Nos. 1 and 2 Pits.

Shipping Ports—Newport, Cardiff, Penarth, Barry.

Rail—Great Western, Pontnewynydd Station.

Canal— . . . .

Black Vein Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

	Per cent.
Carbon	84·86
Hydrogen	4·53
Oxygen	3·21
Nitrogen	0·92
Sulphur	1·17
Ash	5·31
	100·00
Specific gravity	1·34

Notes.

MONMOUTH.

Three-quarter Seam Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

	Per cent.
Carbon	83·88
Hydrogen	4·09
Oxygen	4·67
Nitrogen	0·93
Sulphur	1·40
Ash	5·03
	100·00
Specific gravity	1·309

Big Vein Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

	Per cent.
Carbon	84·39
Hydrogen	5·02
Oxygen	3·16
Nitrogen	0·60
Sulphur	1·79
Ash	5·04
	100·00
Specific gravity	1·319

Analyst—Geo. R. Thompson, F.C.S.

Date of Analysis—February 16, 1894.

Notes.

NORTHUMBERLAND.

ASHINGTON COAL COMPANY LIMITED,

Newcastle-on-Tyne.

Colliery—ASHINGTON, ... Seam, ... Pit.

Shipping Ports—Blyth and the Tyne.

Rail— . . . . Ashington Station.

Canal— . . . .

Ashington Peas Coal.

Class of Coal—Steam

	Per cent.
Fixed carbon	48·97
Volatile hydrocarbons	35·61
Ash	13·70
Sulphur	1·72

Analyst— . . . .

Date of Analysis— . . . .

Ashington Nut Coals.

Class of Coal— . . . .

Yield of gas per ton of coal	9,500 cubic feet
Illuminating power	14 std. sp. candles
Coke	12·6 cwt.

Analyst— . . . . .

Date of Analysis— . . . .

Ashington Duff Coal.

(After treatment by coal washer).

Class of Coal— . . . .

	Per cent.
Fixed carbon	55·12
Volatile hydrocarbons	36·80
Ash	7·10
Sulphur	0·98

Analyst— . . . .

Date of Analysis— . . . . . .

Notes.

NORTHUMBERLAND.

Bothal West Hartley Coal.

Class of Coal—Steam.

	Per cent.
Carbon	80·90
Hydrogen	5·33
Nitrogen	0·96
Oxygen	9·64
Sulphur	0·77
Ash	2·40

Calorific power of coal, 7,955 cal.

Water evaporated from the boiling point by 1 lb. of coal, 14·66 lb.

Analyst—John Pattinson.

Date of Analysis— . . . . . .

Colliery—ASHINGTON, Low Main Seam, Ashington Pit.

Bothal West Hartley Low Main Coal.

Class of Coal—Steam.

	Per cent.
Carbon	82·05
Hydrogen	4·78
Oxygen	9·32
Nitrogen	1·02
Sulphur	0·78
Ash	2·05
Volatile matter at a red heat ..	37·7

Amount of water lost by drying the sample at 212 degs. Fahr., 6·40 per cent.

Calorific power: Water evaporated from 212 degs. Fahr. by 1 lb. of the coal, 15·1 lb.

The Bothal coal is adjudged one of the best steam coals produced in Northumberland, being included in what are termed the "first three." It is largely sold to the Swedish State Railways.

Analysis made on sample when dried at 100 degs. Cent.

Analyst—John Pattinson, F.I.C. F.C.S.

Date of Analysis— . . . . . .

Notes.

NORTHUMBERLAND.

WM. BENSON AND SON,

Collingwood Street, Newcastle-upon-Tyne.

Colliery—MONTAGU, ... Seam, ... Pit.
Shipping Ports—Tyne, Blyth and Sunderland.
Rail— . . . . Lemington Station.
Canal— . . . .

Montagu Unscreened Coal.

Class of Coal—Manufacturing.

Submitted to distillation in a coal-testing apparatus, the following results were obtained :—

Illuminating gas per ton	11,200 cubic feet
Illuminating power of the gas in standard sperm candles	15·86 candles
Sperm value	609·27 lb.
Coke assay—	Per cent.
Volatile matters	29·8
Coke	70·2
Analysis as to ash, &c.—	
Ash	2·93
Sulphur	0·62
Moisture	1·28

Report on coke—"The coke was grey and of good quality."

Analyst—W. H. Blake.

Date of Analysis—November 6, 1907.

Notes.

NORTHUMBERLAND.

OWNERS OF BENTINCK WEST HARTLEY COLLIERY,

Newcastle-on-Tyne.

Colliery—PEGSWOOD (Morpeth), Low Main, Five-quarter, Yard, &c., Seams, Pegswood Pit.
Shipping Ports—Blyth, Tyne and Wear.
Rail—North Eastern, Pegswood Station.
Canal—*Nil.*

Bentinck West Hartley Steam Coals.

Class of Coal—Best Steam, Bunker, and House Coals.

Analysis made on sample when dried at 100 degs. Cent.

	Per cent.
Carbon	80·18
Hydrogen	5·31
Nitrogen	1·77
Oxygen	9·03
Sulphur	0·97
Ash	2·74
	100·00

Calorific power of coal, being weight of water heated from 0 deg. Cent. to 1 deg. Cent. by 1 lb. of coal, 7,916 lb.

Weight of water capable of being evaporated from 100 degs. Cent. by 1 lb. of coal, 14·74 lb.

Analyst—W. W. Proctor.
Date of Analysis—November 13, 1895.

BROOMHILL COLLIERIES LIMITED,

Collingwood Buildings, Newcastle-on-Tyne.

Colliery—BROOMHILL . . . . Seam, ... Pit.
Shipping Port—Amble.
Rail—North Eastern, Amble Station.
Canal—*Nil.*

Broomhill West Hartley Coal.

Class of Coal—Steam, Manufacturing, House.

	Per cent.
Carbon	77·45
Hydrogen	4·93
Nitrogen	1·74
Oxygen	7·99
Sulphur	0·72
Ash	1·52
Moisture	5·65

Analysts—J. and H. S. Pattinson.
Date of Analysis—December 17, 1895.

Notes.

NORTHUMBERLAND.

Broomhill Small Coal.

Class of Coal—Steam, Manufacturing, House

Gave the following result by experiment:—

	Per cent.
Coke	74·20
Volatile matters	25·80

Analysts—J. and H. S. Pattinson.
Date of Analysis—December 17, 1895

BURRADON AND COXLODGE COAL COMPANY LIMITED,

Watergate Buildings, Newcastle-on-Tyne.

Colliery— . . . . Seam, Burradon, Coxlodge, Hazlerigg, Killingworth and Weetslet Pits.

Shipping Ports—Wallsend-on-Tyne, Commissioners' Spouts, Howdon and Albert Edward Docks, Dunston and Tyne Dock.

Rail—North Eastern, Stations all over.

Canal— . . . .

Bower's West Hartley Steam Coal.

Class of Coal—Steam.

	Per cent.
Carbon	80·62
Hydrogen	5·10
Oxygen	6·92
Nitrogen	1·51
Sulphur	0·69
Ash	2·46
Water	2·70
	100·00
Non-volatile matters (coke)	67·9
Volatile matters, including water, expelled at red heat in a closed vessel.. ..	32·1
	100·00

Calorific power: Pounds of water evaporated from 212 degs. Fahr. by 1 lb. of the coal, as ascertained in Thompson's calorimeter .. .. 14·6 lb.

Analysts—J. and H. S. Pattinson.
Date of Analysis—November 13, 1903.

Notes.

NORTHUMBERLAND.

Bower's West Hartley Steam Coal—*cont.*

Another analysis gave the following result:—

	Per cent.
Carbon	80·75
Hydrogen	5·70
Oxygen	6·79
Nitrogen	2·24
Sulphur	0·78
Ash	2·10
Moisture	1·64
	100·00

Coke assay—

Coke..	66·8
Volatile matters	33·2

Calorific power of coal in heat units (weight of water capable of being heated from 0 deg. Cent. to 1 deg. Cent. by 1 lb. of the coal) .. .. 7,956·3 lb.

Water evaporated from 100 degs. Cent. by 1 lb. of the coal 14·62 lb.

(Calorific power estimated by Thompson's calorimeter.)

Analyst—W. H. Blake.

Date of Analysis—December 11, 1903.

COWPEN COAL COMPANY LIMITED,

Blyth.

Colliery— . . . . Low Main and Yard Seams, North Seaton, Cambois, Cowpen and Newsham Pits.

Shipping Port—Blyth.

Rail— . . . . Station.

Canal— . . . .

Cowpen West Hartley Coal.

Class of Coal—Steam.

This coal is also one of the "first three" Northumberland qualities, and is considered a standard north-country steam coal.

	Per cent.
Carbon	79·46
Hydrogen	4·89
Oxygen	11·07
Nitrogen	1·02
Sulphur	0·83
Ash	2·73
	100·00
Moisture (when dried at 100 degs. Cent.)..	8·17

NORTHUMBERLAND.

Notes.

Assay for coke—

	Per cent.
Coke	68·27
Volatile matters	31·73

Calorific power of coal in Centigrade heat units (being weight of water capable of being heated from 0 to 1 deg. Centigrade by 1 lb. of coal) = 7,627 lb.

Water capable of being evaporated from 100 degs. Cent. by 1 lb. of coal = 14·2 lb.

Analyst—W. W. Proctor.

Date of Analysis—May 1, 1901.

ELSWICK COAL COMPANY LIMITED,

Newcastle-on-Tyne.

Colliery—ELSWICK, Brockwell Seam, Elswick and North Elswick Pits.

Shipping Port—River Tyne (above bridge) at Elswick Private Staith.

Rail— . . . . . . Station.

Canal— . . . . . .

Elswick Gas Coal.

Class of Coal—Gas, Coking, Manufacturing, and House (latter not for shipment).

On submitting the sample to distillation in a coal-testing apparatus, 10,000 cubic feet of gas were obtained per ton of coal, having an illuminating power equal to 16·3 standard sperm candles when burning at the rate of 5 cubic feet per hour, through Sugg's No. 1 London Argand burner.

The coke assay gave as follows:

	Per cent.
Coke	71·9
Volatile matters	28·1
There is a high yield of coke of good quality.	100·0

A complete "ultimate" analysis of the coal was made, and the following results obtained:—

	Per cent.
Carbon	81·93
Hydrogen	4·85
Oxygen	6·47
Nitrogen	0·69
Sulphur	0·65
Ash	3·86
Water	1·55
The above results show that this is a very pure sample of coal.	100·00

Analyst—Jno. Pattinson, F.I.C., F.C.S.

Date of Analysis— . . . . . .

Notes.

NORTHUMBERLAND.

Colliery—ELSWICK, Tilley Seam, Elswick and North Elswick Pits.

Tilley Seam Coal.

Class of Coal—Gas, Coking and Manufacturing.

Analysis of a sample of Tilley seam coal sampled by me at Elswick Colliery for the Elswick Coal Company Limited, Newcastle-on-Tyne.

The assay gave results as follows:—

	Per cent.
Coke..	72·50
Volatile matter	27·50

The coke was silvery grey in colour, hard, fibrous, and of good cell structure.

Illuminating gas per ton	10,500 cubic feet
Illuminating power of gas	18·90 std. sp. candles
Sperm value	680·4 lb.
Moisture	1·08 per cent.
Sulphur	0·72 per cent.
Ash	2·80 per cent.

Analyst—W. H. Blake, F.C.S.

Date of Analysis— . . . .

Colliery—ELSWICK, Three-quarter Seam, Elswick and North Elswick Pits.

Three-quarter Seam Coal.

Class of Coal—Gas, Coking and Manufacturing,

	Per cent.
Coke..	72·50
Volatile matter	27·50

The coke was good, hard, grey, fibrous and of good cell structure.

Illuminating gas per ton	10,500 cubic feet
Illuminating power of gas	18·90 standard sperm candles
Sperm value	680·4 lb.
Moisture	1·08 per cent.
Sulphur	0·72 per cent.
Ash	2·80 per cent.

Analyst—W. H. Blake, F.C.S.

Date of Analysis— . . . .

NORTHUMBERLAND.

Notes.

NORTH WALBOTTLE COAL COMPANY LIMITED.

10, Queen Street, Quayside, Newcastle-on-Tyne.

Colliery—NORTH WALBOTTLE, Beaumont Seam, Betty Pit.

Shipping Ports—Dunston, Tyne Dock, Albert Edward and Howden Docks, Commissioners' Spouts.

Rail—North Eastern, Lemington-on-Tyne Station.

Canal— . . . .

Whorlton Wallsend House Coal.

Class of Coal—House.

Moisture determined by drying at 212 degs. Fahr., 4.37 per cent. Analysis made on sample when dried at 212 degs. Fahr.:—

	Per cent.
Carbon	84·50
Hydrogen	5·15
Nitrogen	1·43
Oxygen	6·93
Sulphur	0·63
Ash	1·36
	100·00

Calorific power of coal in Centigrade heat units, being weight of water heated by 1 lb. of coal from 0 deg. Cent. to 1 deg. Cent.	8,303 lb.
Water heated from 32 degs. Fahr. to 33 degs. Fahr. by 1 lb. of coal	14,946 lb.
Evaporative power of coal, being pounds of water capable of being evaporated from 100 degs. Cent. (212 degs. Fahr.) by 1 lb. of coal	15·46 lb.

Analyst—W. W. Proctor.

Date of Analysis—July 28, 1897.

Notes.

NORTHUMBERLAND.

Whorlton Hartley Steam Coal.

Class of Coal—Steam.

Moisture by drying the sample at 212 degs. Fahr .. 3·14 per cent.

Analysis made on sample when dried at 212 degs. Fahr.:—

	Per cent.
Carbon	82·14
Hydrogen	5·05
Nitrogen	1·18
Oxygen	6·80
Sulphur	1·17
Ash	3·66
	100·00

Calorific power of coal in Centigrade heat units, being weight of water heated by 1 lb. of coal from 0 deg. Cent. to 1 deg. Cent. .. .. 8,081 lb.

Water heated from 32 degs. F. to 33 degs. F. by 1 lb. of coal 14,546 lb.

Evaporative power of coal, being pounds of water capable of being evaporated from 100 degs. Cent. (212 degs. Fahr.) by 1 lb. of coal .. .. 15·05 lb.

Analyst—W. W. Proctor.

Date of Analysis—July 28, 1897.

Whorlton Gas Coal.

Class of Coal—Gas.

Quantity of gas per ton of coal .. 10,500 cubic feet
Illuminating power of gas .. .. 17 standard candles
Tested by the No. 1 London standard Argand burner.
Coke per ton of coal .. .. .. 1,524 lb.
Coke .. .. 68 per cent.
Volatile matter .. .. 32 per cent.

Appearance of coke fairly good. This is an excellent sample of coal for gas making purposes.

Analyst—W. W. Proctor.

Date of Analysis—September 22, 1898.

NORTHUMBERLAND.

Notes.

U. A. RITSON AND SONS LIMITED,

Milburn House, Newcastle-on-Tyne.

Colliery—PRESTON, ... Seam, ... Pit.
Shipping Ports—Northumberland Dock, Albert Edward Dock, and Commissioners' Staiths.
Rail—North Eastern, North Shields Station.
Canal— . . . . . .

Preston West Hartley Steam Coal.

Class of Coal—Steam.

Water, determined by drying at 100 degs. Cent. = 6·48 per cent. Analyses made on sample when dried at 100 degs. Cent.:—

	Per cent.
Carbon	77·17
Hydrogen	4·58
Oxygen	13·20
Nitrogen	1·83
Sulphur	0·93
Ash	2·29
	100·00

Calorific power of coal in Centigrade heat units, being pounds of water heated from 0 deg. Cent. to 1 deg. Cent. by 1 lb. of coal = 8,062. Pounds of water capable of being evaporated from 100 degs. Cent. by 1 lb. of coal = 15.

Analyst—W. W. Proctor.

Date of Analysis—April 10, 1899

Notes.

NORTHUMBERLAND.

SEATON BURN COAL COMPANY LIMITED,

4, Lombard Street, Newcastle-on-Tyne.

Collieries—SEATON BURN AND DINNINGTON . . . . . . Seam . . . . Pit.

Shipping Ports—Tyne, Blyth, and Wear, also Private Staiths in River Tyne.

Rail—North Eastern, Killingworth Station.

Canal— . . . . . .

Ravensworth West Hartley Steam Coal.

Class of Coal—Steam.

	Per cent.
Carbon	75·05
Hydrogen	4·91
Oxygen	7·87
Nitrogen	1·80
Sulphur	1·04
Ash	1·86
Water	7·47
Coke assay—	
Coke..	57·5
Volatile matters	42·5

Calorific power: Water evaporated from 212 degs. Fahr. by 1 lb. of the coal, 13·7 lb.

Another analysis gave the following results:—

	Per cent.
Carbon	75·05
Hydrogen	4·78
Oxygen	8·01
Nitrogen	1·83
Sulphur	0·67
Ash	1·40
Water	8·26
Coke assay—	
Coke..	58·7
Volatile matters	41·3

Calorific power: Water evaporated from 212 degs. Fahr. by 1 lb. of the coal, 13·7 lb.

Analysts—J. and H. S. Pattinson.

Date of Analysis—March 11, 1901.

NORTHUMBERLAND.

Notes.

Wharncliffe Wallsend Household Coal.

Class of Coal—House.

	Per cent.
Carbon	75·93
Hydrogen	4·84
Oxygen	7·91
Nitrogen	1·75
Sulphur	0·54
Ash	1·70
Water	7·33
Coke	58·3
Volatile matters	41·7

Analysts—J. and H. S. Pattinson.
Date of Analysis—March 11, 1901.

Beaumont Wallsend Coal.

Class of Coal—House.

Moisture, determined by drying at 100 degs. Cent. (212 degs. Fahr.) equals 3·58 per cent. Analysis on sample when dried at 100 degs. Cent.:—

	Per cent.
Carbon	80·33
Hydrogen	5·03
Nitrogen	1·18
Oxygen	9·64
Sulphur	0·63
Ash	3·19
	100·00
Calorific power of coal, in Centigrade heat units, being pounds of water heated by 1 lb. of coal from 0 deg. Cent. to 1 deg. Cent. equals	7,808 lb.
Pounds of water heated from 32 degs. Fahr. to 33 degs. Fahr. by 1 lb. of coal equals ..	14,054 lb.
Evaporative power of coal, being pounds of water capable of being evaporated from 100 degs. Cent. (212 degs. Fahr.) by 1 lb. of coal equals	14·54 lb.

This is a nice clean sample of house coal, almost free from sulphur, and yielding not much ash of a reddish colour. It is a good coal for household and other heating purposes.

Analyst—W. W. Proctor, F.I.C.
Date of Analysis—September 17, 1901.

Notes.

NORTHUMBERLAND.

SEATON DELAVAL COAL COMPANY LIMITED,

Newcastle-on-Tyne.

Colliery—SEATON DELAVAL.
Shipping Port—Northumberland Dock, Tyne.
Rail—Seaton Delaval Station.
Canal— . . . .

Hastings Hartley Main Steam Coal.

Class of Coal—Steam.

Analysis made on sample when dried at 100 degs. Cent. :—

	Per cent.
Carbon	79·63
Hydrogen	5·05
Nitrogen	1·02
Oxygen	10·75
Sulphur	0·75
Ash	2·81
	100·00

Assay for coke—

Coke	65·83
Volatile matters	34·17
	100·00

Calorific power of coal in Centigrade heat units, being pounds of water heated from 0 deg. Cent. to 1 deg. Cent. by 1 lb. of coal, 7,709 lb. Pounds of water capable of being evaporated from 100 degs. Cent. by 1 lb. of coal, 14·35 lb.

Analyst—W. W. Proctor.
Date of Analysis—February 22, 1886.

NORTHUMBERLAND.

Notes.

STOBSWOOD COAL COMPANY,

9, Sandhill, Newcastle-on-Tyne.

Colliery—STOBSWOOD, Main Seam, Stobswood Pit.
Shipping Ports—Blyth, Amble, Howdon Dock, Commissioners' Spouts, Dunston, and Tyne Dock.
Rail— . . . . Widdrington Station.
Canal— . . . .

Northumberland West Hartley Steam Coal.

Class of Coal—Steam.

Sample dried at 212 degs. Fahr.—	Per cent.
Carbon	80·66
Hydrogen	5·15
Oxygen	9·02
Nitrogen	0·80
Sulphur	0·57
Ash	3·80
	100·00

Water lost by drying the sample at 212 degs. F.	4·24 per cent.
Calorific power as determined by Thompson's calorimeter, pounds of water evaporated from 212 degs. Fahr. by 1 lb. of the coal ..	13·9 lb.

Analysts—J. and H. S. Pattinson.
Date of Analysis—March 11, 1880.

WALLSEND AND HEBBURN COAL COMPANY LIMITED,

Newcastle-on-Tyne.

Collieries—WALLSEND (Northumberland) and HEBBURN (Durham), Hudson and Bensham Seams, ... Pit.
Shipping Ports—Private Staiths, River Tyne and Docks.
Rail—North Eastern, Hebburn Station.
Canal— . . . .

Hebburn Main Gas Coal.

Class of Coal—Gas, Manufacturing.

Three samples were analysed with the following results:—

Yield of gas per ton of coal..	10·600	.. 10·800	.. 10·600	cubic feet
Illuminating power of gas ..	16·5	.. 17·0	.. 16·6	std. candles

Notes.

NORTHUMBERLAND.

Hebburn Main Gas Coal—*cont.*

These results were obtained on submitting the coals to distillation in a coal-testing apparatus, and by burning the gas so obtained at the rate of 5 cubic feet per hour in a photometer fitted with the No. 1 London Argand standard burner.

The coals yielded the following percentage amounts of coke and volatile matters :—

	Per cent.	Per cent.	Per cent.
Coke	69·5	68·2	70·1
Volatile matters	30·5	31·8	29·9
	100·0	100·0	100·0

All the coals coked well, and are good for gas-making purposes.

The above samples were taken from three different parts of the mines.

Analysts—J. and H. S. Pattinson.

Date of Analysis—August 7, 1900.

WANSBECK COLLIERY COMPANY LIMITED,

A, Exchange Buildings, Newcastle-on-Tyne.

Colliery—WANSBECK, ... Seam, Morpeth Moor Pit.

Shipping Ports—Blyth, Dunston, and Northside of Tyne.

Rail—North Eastern, Morpeth Station.

Canal— . . . .

"Little Seam" Nuts, "Old Man's Seam" Unscreened.

Class of Coal— . . . .

	"Little Seam." Nuts.	"Old Man's Seam." Unscreened.
Yield of gas per ton of coal in cubic feet	10,700	10,600 cubic feet
Illuminating power of gas in standard sperm candles	15·9	15·3 std. candles
Illuminating value of gas, expressed in pounds of sperm per ton of coal ..	583	556 lb. sperm

The coals yielded the following percentage of coke and volatile matters :—

	Per cent.	Per cent.
Non-volatile matters (coke)	61·1	61·8
Volatile matters, including water, expelled at a temperature of 1,000 degs. Cent. in a closed vessel	38·9	38·2
	100·0	100·0

Notes.

NORTHUMBERLAND.

A complete ultimate analysis was made of each coal, and the following results were obtained :—

	"Little Seam." Nuts. Per cent.	"Old Man's Seam." Unscreened. Per cent.
Carbon	67·64	70·47
Hydrogen	4·67	4·42
Oxygen	7·82	7·49
Nitrogen	1·20	1·26
Sulphur	1·54	1·61
Ash	11·77	8·34
Water	5·36	6·41
	100·00	100·00

Calorific powers :—

Pounds of water evaporated from 212 degs. Fahr. by 1 lb. coal	12·5 lb.	12·8 lb.

Both these coals are fairly good gas coals, and when treated for gas they leave a fairly good, though not very hard, coke. They are both free-burning, long-flame coals, and could be used either for steam-raising or for household purposes, though the calorific values are not high enough for a steam coal of the first grade, and the nuts contain rather a high percentage of ash.

Analysts—J. and H. S. Pattinson.

Date of Analysis—March 16, 1906.

Notes.

NOTTINGHAM.

BESTWOOD COAL AND IRON COMPANY LIMITED,

near Nottingham.

Colliery—BESTWOOD, Top Hard Seam, ... Pit.
Shipping Ports—Boston, Lynn, Hull, Grimsby.
Rail—Midland, Great Northern, Great Central, and L. and N. W , Bestwood Colliery Station.
Canal— . . . .

Bestwood Top Hard Steam Coal.

Class of Coal—Steam, Manufacturing House.

The following is an analysis of a sample of Bestwood best double-screened and hand-picked steam coals.

	Per cent.
Fixed carbon	55·80
Volatile matter	31·15
Moisture	8·26
Ash	4·79
Sulphur	0·73
Calorific power in pound degs. Cent. per pound of coal burnt	770·6 lb.
Water at 212 degs. Fahr. converted into steam at 212 degs. Fahr. by 1 lb. coal	14·36 lb.

Analyst—L. T. O'Shea.
Date of Analysis—December 21, 1905.

CLIFTON COLLIERY COMPANY,

Nottingham.

Colliery—CLIFTON, Deep Hard Seam, Clifton Nos. 1 and 2 Pits.
Shipping Ports—Hull, Grimsby, Boston, Lynn and Partington.
Rail—Midland, Great Central, Great Northern and L. and N. W., Nottingham Station.
Canal—Trent Navigation.

Picked Hards.

Class of Coal—Steam.

	Per cent.
Carbon	74·04
Ash	6·16
Hydrogen	4·80
Nitrogen	1·06
Sulphur	1·02
Oxygen	12·92
	100·00
Evaporative power	14·47 lb.

Analyst—S. R. Trotman.
Date of Analysis—1905.

NOTTINGHAM.

Notes.

Large Cobbles.

Class of Coal—Steam, Manufacturing.

	Per cent.
Carbon	74·60
Ash	4·30
Hydrogen	5·06
Nitrogen	0·96
Sulphur	1·13
Oxygen	13·95
	100·00
Evaporative power	12·6 lb.

Analyst—S. R. Trotman.
Date of Analysis—1905.

Cannel.

Class of Coal—Gas.

	Per cent.
Carbon	71·77
Hydrogen	6·12
Nitrogen	0·49
Oxygen	11·87
Sulphur	1·45
Ash	8·30
	100·00
Make of gas at N.T.P.	12,800 cubic feet
Illuminating power of gas	23·4 candles
Yield of coke per ton	9¾ cwt.
Quality	Fair cannel coke

Analyst—S. R. Trotman.
Date of Analysis—1905.

Notes.

NOTTINGHAM.

Colliery—CLIFTON, Deep Soft Seam, Nos. 1 and 2 Pits.

Small Bright Nuts.

Class of Coal—Gas, Steam, Manufacturing, House.

	Per cent.
Carbon	72·46
Hydrogen	4·20
Nitrogen	1·10
Oxygen	15·17
Sulphur	1·23
Ash	5·84
	100·00

Make of gas per ton at N.T.P.	10,610 cubic feet.
Illuminating power of gas	13·98 candles
Yield of coke per ton	12 cwt.
Quality of coke	Fair

Analyst—S. R. Trotman.

Date of Analysis—1905.

Bright Pea Nuts.

Class of Coal—Steam, Manufacturing, House.

	Per cent.
Carbon	71·18
Hydrogen	4·55
Nitrogen	0·83
Oxygen	14·06
Sulphur	1·88
Ash	7·50
	100·00

Make of gas per ton at N.T.P.	10,050 cubic feet
Illuminating power of gas	14·2 candles
Yield of coke per ton	10¼ cwt.

Analyst—S. R. Trotman.

Date of Analysis—1905.

Notes.

NOTTINGHAM.

DIGBY COLLIERY COMPANY LIMITED,

Digby Collieries, near Nottingham.

Collieries—DIGBY, Bottom Soft and Bottom Hard Seams; GEDLING, Top Hard and High Hazel Seams, ... Pit.

Shipping Ports—Lynn, Boston, Hull, Grimsby.

Rail—Midland, Great Northern, L. and N. W., Great Central, Kimberley and Gedling Stations.

Canal—Nottingham and Grantham, 3 miles from Langley Mill.

Digby and Gedling House Coals.

Class of Coal—House.

	Derby Main Bright.	Giltbrook Bright.	Gedling High Hazel or Ashless.
Carbon	77·30	78·20	79·04 per cent.
Hydrogen	4·77	4·74	5·75 per cent.
Nitrogen	1·47	1·45	0·98 per cent.
Oxygen	13·85	12·19	11·77 per cent.
Sulphur	1·23	1·40	1·06 per cent.
Ash	1·38	2·02	1·40 per cent.
	100·00	100·00	100·00

Digby and Gedling Large Steam or Furnace Hards.

Class of Coal—Blast Furnace, Steam, Manufacturing.

	Digby Picked Hard.	Gedling Picked Hard.
Carbon	75·09	76·15 per cent.
Hydrogen	4·51	3·19 per cent.
Oxygen	12·13	11·98 per cent.
Nitrogen	1·21	0·99 per cent.
Sulphur	0·69	0·86 per cent.
Ash	6·37	6·83 per cent.
	100·00	100·00
Coke	60·1	69·75 per cent.
Volatile matter	39·9	30·25 per cent.
Moisture	8·37	4·30 per cent.
Calorific value in B.T.U.'s	13,030	14,037 B.T.U.

Notes.

NOTTINGHAM.

Digby and Gedling Nuts for Steam.

Class of Coal—Steam.

	Digby Pea Nuts, from Main Bright.	Digby Pea Nuts, from Giltbrook.	Gedling Small Nuts, from Top Hard.	Gedling Small Nuts, from High Hazel or Ashless coal.
Water	7·73 ..	4·73 ..	7·92 ..	10·81 per cent.
Ash	3·86 ..	2·10 ..	4·32 ..	1·38 per cent.
Sulphur	1·49 ..	0·94 ..	1·01 ..	1·07 per cent.
Calorific value in B.T.U.'s	13,781 ..	14,995 ..	13,990 ..	14,000 B.T.U.

Analyst—S. R. Trotman, M.A., F.I.C.

Date of Analysis—May 1906.

SHERWOOD COLLIERY COMPANY LIMITED,

Mansfield.

Colliery—SHERWOOD, Top Hard Seam, Sherwood Pit.

Shipping Port— . . . .

Rail—Midland, Mansfield-Woodhouse Station.

Canal—*Nil.*

Bright Coal.

Class of Coal—Steam, Manufacturing, House.

	Per cent.
Proximate composition—	
Fixed carbon	54·18
Volatile constituents	34·24
Ash	2·08
Water (expelled at 212 degs. Fahr.) ..	9·50
	100·00
Coke	56·26
Ultimate composition—	
Carbon	72·44
Hydrogen	5·26
Oxygen	7·80
Nitrogen	1·71
Sulphur	1·21
Ash	2·08
Water (expelled at 212 degs. Fahr.) ..	9·50
	100·00

NOTTINGHAM.

Notes.

Calorific value—

This, as determined by Thompson's calorimeter, and expressed in British thermal units, is .. .. 12,058 B.T.U.

That is to say, 1 lb. of coal would be capable of evaporating 12·4 lb. of water at 212 degs. Fahr.

Analysts—The "Quarry" Testing, Analysing, and Investigation Department.

Date of Analysis—October 24, 1904.

Best Hard Coal.

Class of Coal—Steam, Manufacturing, House.

	Per cent.
Proximate composition—	
Fixed carbon	57·19
Volatile constituents..	32·30
Ash	2·38
Water (expelled at 212 degs. Fahr.) ..	8·13
	100·00
Coke	59·57
Ultimate composition—	
Carbon	76·10
Hydrogen	5·11
Oxygen	5·84
Nitrogen	1·58
Sulphur	0·86
Ash	2·38
Water (expelled at 212 degs. Fahr.) ..	8·13
	100·00

Calorific value—

This, as determined by Thompson's calorimeter, and expressed in British thermal units, is .. .. 12,348 B.T.U.

That is to say, 1 lb. of coal would be capable of evaporating 12·8 lb. of water at 212 degs. Fahr.

Analysts—The "Quarry" Testing, Analysing, and Investigation Department.

Date of Analysis—October 24, 1904.

Notes.

NOTTINGHAM.

Top Hard Seam Coal.

Class of Coal— . . . .

In dry coal—	Per cent.
Carbon	81·43
Hydrogen	5·48
Nitrogen	1·34
Sulphur	0·74
Ash	3·23
Oxygen, with traces of chlorides, &c.	7·78
	100·00
British thermal units	14,454

The British thermal units determined by Thompson's calorimeter and stated on the dry coal.

Analyst—W. H. Blake, F.C.S.
Date of Analysis—December 23, 1907.

SHIREBROOK COLLIERY LIMITED,

near Mansfield.

Colliery—SHIREBROOK, Top Hard or Barnsley Bed Seam, ... Pit.

Shipping Port—Hull.

Rail—Midland, Great Central, Great Northern, Shirebrook Station.

Canal— . . . .

Shirebrook Best Steam Hards.

Class of Coal—Steam.

In dry coal—	Per cent.
Carbon	81·23
Hydrogen	5·04
Nitrogen	1·44
Sulphur	·71
Ash	2·49
Oxygen—with traces of chlorides, &c...	9·09
	100·00

A compact, clean coal, with a high evaporating power. Contains but 2½ per cent. of ash and is very free from pyrites; the total sulphur is less than ¾ per cent. Similar in composition to the best Elsecar coals.

Analyst—Edward Kinch, F.I.C.
Date of Analysis—December 24, 1900.

NOTTINGHAM.

Notes.

Shirebrook D.S. Nuts.

Class of Coal—House.

Moisture in sample	7·46 per cent.
Composition of dry coal—	Per cent.
Carbon	79·64
Hydrogen	5·34
Oxygen and Nitrogen	10·21
Sulphur	1·61
Ash	3·20
	100·00

On distillation at moderately low temperature it yielded 72 per cent. of coke; at a high temperature the yield was 60 per cent. coke. The coal is rather too light and rich to give high effects in producer gas; the coke, however, could be used for this purpose, but it is somewhat brittle.

It is a good, free-burning coal, and is excellently suited for gas-making or domestic use, the yield of gas at a fairly high temperature corresponding to some 10,500 cubic feet per ton of 16-candle power.

Analyst—Francis M. Rogers, F.C.S.

Date of Analysis—March 13, 1902.

STANTON IRONWORKS COMPANY,

Teversal, Mansfield.

Colliery—TEVERSAL, ... Seam, Silverhill Pit.

Shipping Ports—Hull, Grimsby, Partington, Lynn, Boston.

Rail—Midland, Great Northern, L. and N. W., Great Central, Teversal Station, Midland.

Canal—*Nil.*

Silverhill Main Gas Coal.

Class of Coal—Gas.

A sample of this coal, representing the product of the seam, gave on examination the following results:—

The seam consists of cannel and bituminous coal; all black and possessing very high lustre and brown streak; cannel portion irregular in fracture to semi-conchoidal and curly in cross-fracture, while bituminous portion is highly resinoid in both fractures with slight deposits of charcoal, as also calcic carbonate and ferric bisulphide; moderately cohesive and compact. On the fire it intumesces and partly agglomerates. Colour of ash, brown and flocculent. Mean specific gravity, 1,254 (water, 1,000); weight of 1 cubic foot, 78·37 lb.

Notes.

NOTTINGHAM.

		Per cent.
Volatile matter (containing 0·33 of sulphur)		35·54
Coke, consisting of—		
Carbon	57·63	
Sulphur	0·18	
Ash	1·55	
		59·36
Water expelled at 212 degs. Fahr. ..		5·10
		100·00

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar.	12,022 cubic feet
Gas from 1 cubic foot of the coal	420·60 cubic feet
Specific gravity of the gas	556 (air 1,000)
Hydrocarbons absorbed by bromine ..	6·66 per cent.
Durability of 1 cubic foot by 5 in. jet flame	44 min. 27 sec.
Value of 1 cubic foot of gas	533·76 grains sperm
Value of gas from 1 ton of coal	919·87 lb. sperm
Illuminating power of gas in standard candles (per London Argand)	22·24 candles
Sulphuretted hydrogen (H_2S) in foul gas	0·75 per cent.
Carbonic acid (CO_2) in foul gas	0·80 per cent.
Carbonic oxide (CO) in foul gas	9·00 per cent.
Sulphur eliminated with volatile products	7·45 lb.
Liquid products—	
Tar per ton of coal	17·50 gallons
Ammoniacal liquor, per ton of coal ..	19·94 gallons
Strength of ammoniacal liquor	3·00 degs. Twadd.
Hygrometric water per ton of coal ..	11·42 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	7·36 per cent.
Solid products—	
Coke per ton of coal	1,330·66 lb.
Carbon in the coke	97·40 per cent.
Ash in the coke	2·60 per cent.
Sulphur in coke per ton of coal	4·03 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)..	13·38 lb.

This coal yields a large volume of gas and 11·88 cwt. of coke of remarkably pure quality. The foul gas at same time contains an exceptionally small amount of impurities. Compared with Main Lesmahagow cannel coal represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 72·63.

Analyst—Geo. R. Hislop.

Date of Analysis—February 2, 1895.

Notes.

SHROPSHIRE.

LILLESHALL COMPANY LIMITED,

Priors Lee Hall, Shifnal.

Collieries—DONNINGTON and PRIORS LEE, ... Seam, Various Pits.

Shipping Ports—Nil.

Rail—Great Western, L. and N. W., Oakengates and Donnington Stations.

Canal—Shropshire Union.

Flint Coal, Deep Coal.

Class of Coal—House and Manufacturing.

	Flint coal. Per cent.	Deep coal. Per cent.
Fixed carbon	45·59	49·25
Volatile hydrocarbons, &c.	37·07	32·53
Moisture	10·76	14·13
Ash	5·36	3·32
Sulphur	1·22	·77
	100·00	100·00

All the seams are very similar to the above analytically, being high in volatile matter and low in fixed carbon.

Analyst—G. A. Jarvis, F.C.S.

Date of Analysis—June 10, 1905.

Notes.

SOMERSETSHIRE.

DUNKERTON COLLIERIES LIMITED,

Peasedown St. John, near Bath.

Colliery—DUNKERTON, Great Vein Seam, ... Pit.

Shipping Ports—Bristol and Avonmouth.

Rail—Great Western, Camerton Station.

Great Vein Coal.

Class of Coal—Gas and Steam.

The coal was submitted to distillation in a coal-testing apparatus at a temperature of 1,000 degs. Cent., and yielded gas at the rate of 12,400 cubic feet per ton of coal. The gas was burnt in a photometer fitted with the No. 1 London Argand standard burner at such a rate as to give the maximum efficiency of illumination. The proportionate illuminating power of the gas, calculated to the standard rate of consumption of 5 cubic feet per hour, was found to be equal to 16·5 standard sperm candles. The illuminating value of the gas per ton of coal expressed in pounds of sperm is 701.

The coal yielded the following percentage amounts of coke and volatile matters:—

	Per cent.
Non-volatile matters (coke)	60·6
Volatile matters, including water expelled at a temperature of 1,000 degs. Cent. in a closed vessel	39·4

A complete "ultimate" analysis of the coal was made, and the following results were obtained:—

	Per cent.
Carbon	81·64
Hydrogen	5·29
Oxygen	5·12
Nitrogen	1·46
Sulphur	0·67
Ash	4·10
Water	1·72
	100·00

Calorific power: Pounds of water evaporated from 212 degs. Fahr. by 1 lb. of coal .. 15·2

This is an excellent coal for gasmaking purposes, having an unusually high sperm value. It is low in ash and sulphur, and has a high calorific value. These qualities fit it well for use as a steam coal.

Analysts—J. and H. S. Pattinson.

Date of Analysis—October 17, 1906.

GREYFIELD COLLIERY COMPANY LIMITED,

Clutton, Bristol.

Shipping Ports—Bristol and Avonmouth.

Rail—Great Western, Clutton Station.

SOMERSETSHIRE.

Notes.

Colliery—GREYFIELD, Dabchick Seam, Greyfield Pit.

Dabchick Vein Coal.

Specific gravity	1·278
Coke (12 cwt. 0 qr. 5 lb.)	60·26 per cent.
Volatile products	32·24 per cent.
Sulphur	1·53 per cent.
Ash	7·50 per cent.
Purified gas per ton	10,837 cubic feet
Sulphuretted hydrogen in crude gas	0·26 per cent.
Carbonic acid in crude gas	1·82 per cent.
Carbonic oxide in purified gas	7·35 per cent.
Illuminating power when burned in the London Argand at the rate of 5 ft. per hour (each 120 grs. per hour)	19·16 candles
Heating power	13·88 lb.
Carbon	84·38 per cent.
Hydrogen	5·15 per cent.
Oxygen	0·73 per cent.
Nitrogen	0·71 per cent.
Value of gas per ton of coal	718·33 lb. sperm

Analyst—Alexander Fiddes.

Date of Analysis— . . . .

Miss E. E. JARRETT,

Camerton Collieries, Bath.

Colliery—CAMERTON, ... Seam, ... Pit.

House, Gas, and Steam Coals.

Rail—Great Western, Camerton Station.

Camerton Gas Coal (Block Coal).

Class of Coal—Gas.

Specific gravity of the coal	1·271
Fixed products or coke, 1,462 lb. . .	65·31 per cent.
Volatile products	34·69 per cent.
Sulphur in the coal	0·95 per cent.
Ash in the coal	3·82 per cent.
Quantity of purified gas per ton at 30 in. bar. and 60 degs. Fahr.	11,180 cubic feet
Sulphuretted hydrogen in the crude gas ..	0·37 per cent.
Carbonic acid in the crude gas	3·70 per cent.
Hydrocarbons condensable by bromine in the purified gas	6·29 per cent.
Carbonic acid condensable by bromine in the purified gas	4·62 per cent.

Notes.

SOMERSETSHIRE.

Camerton Gas Coal (Block Coal)—*cont.*

The illuminating power of the gas when burned in the London Argand at a rate of 5 cubic feet per hour was equal to the light of 18·74 spermaceti candles, each consuming 120 grains per hour. Value of one ton of coal in pounds of sperm, 718. The heating power of the coal is 14·00, or 1 lb. of this coal by its perfect combustion will convert 14 lb. of boiling water into steam.

Mr. J. Harger Pye, on June 29, 1901, made a working test of partly screened Camerton coal, and found that under favourable circumstances it had produced 11,233 cubic feet of 16-candle power gas, with 1,210 lb. of coke per ton of coals.

Analyst—Alex. H. Fiddes.

Date of Analysis—August 19, 1889.

Camerton Gas Coal (Small Coal).

Class of Coal—Gas.

Specific gravity of the coal (water being 1·000)	1·278
Fixed products, or coke (1,488 lb.)	66·45 per cent.
Volatile products	33·55 per cent.
Sulphur in the coal	1·41 per cent.
Ash in the coal	10·70 per cent.
Purified gas per ton at 30 in. bar. and 60 degs. F.	11,134 cubic feet
Sulphuretted hydrogen in the crude gas ..	0·58 per cent.
Carbonic acid in the crude gas	3·16 per cent.
Hydrocarbons condensable by bromine in the purified gas	5·84 per cent.
Carbonic oxide in the purified gas	5·57 per cent.

The illuminating power of the gas when burned in the London Argand at a rate of 5 cubic feet per hour was equal to the light of 18·19 spermaceti candles, each consuming 120 grains per hour.

Value of 1 ton of the coal in sperm	694 lb.
Heating power of the coal, or weight of boiling water converted into steam	12·9 lb.

Analyst—Alexander H. Fiddes.

Date of Analysis—August 19, 1887.

SOMERSETSHIRE.

Notes.

SAMBORNE, SMITH & CO.,

Timsbury, Bath.

Colliery—TIMSBURY, ... Seam, Nos. 1 and 2 Pits.
Shipping Port—Avonmouth.
Rail—Great Western, Timsbury Sidings, *viâ* Hallatrow Station.
Canal— . . . .

Tinsbury Gas Coal.

Class of Coal—Gas.

I have examined the sample of Timsbury through coal, forwarded on the 17th, and claimed to be a fair sample of the whole section of the seam. It is an excellent gas coal, burning off freely in the retort, and giving a very large yield of high power gas, together with a high proportion of coke of hard and good quality.

Specific gravity	1·318
Weight of 1 cubic foot	82 lb. 6 oz.
Proximate analysis—	Per cent.
Loss by exposure to 212 degs. Fahr.	1·60
Sulphur	1·22
Volatile matter	28·38
Fixed carbon	64·08
Ash (light gravel-red colour) ..	4·72
	100·00
Working analysis (per ton of 2,240 lb.)—	
Gas corrected to 60 degs. Fahr. and 30 in. bar.	12,357 cubic feet
Illuminating power	17·2 candles
Coke weighed dry	13 cwt. 88 lb.
Tar	12 gallons
Liquor	9 gallons
Value of 1 cubic foot	408 grains sperm
Value of 1 ton of coal	727 lb. sperm

Analyst—N. H. Humphrys, A.M.I.C.E., F.C.S., &c.

Date of Analysis—April 27, 1905.

Notes.

STAFFORDSHIRE.

CANNOCK AND RUGELEY COLLIERY COMPANY LIMITED,

Hednesford.

Colliery— . . . . Deep, Shallow and Six Feet Seam, Cannock Wood Mine Pit.

Shipping Port—*Nil.*

Rail—L. and N. W. and Midland, Hednesford Station.

Canal—Hednesford Basin.

Deep Seam.

Class of Coal—House and Steam.

	Per cent.
Fixed carbon	52·03
Volatile products	32·97
Ash	1·02
Sulphur	0·50
Moisture	13·48

Shallow Seam.

Class of Coal—House and Steam.

	Per cent.
Fixed carbon	49·08
Volatile products	34·03
Ash	2·78
Sulphur	0·91
Moisture	13·20

Six-feet Seam.

Class of Coal—House and Steam.

	Per cent.
Fixed carbon	48·24
Volatile products	33·59
Ash	3·01
Sulphur	1·06
Moisture	14·10

Analyst—F. Hunting.

Date of Analysis—December 8, 1903.

STAFFORDSHIRE.

Notes.

CHATTERLEY-WHITFIELD COLLIERIES LIMITED,
Tunstall.

Colliery—WHITFIELD, Hard Mine Seam, Middle Pit.

Shipping Ports—Birkenhead, Ellesmere Port, Runcorn, Garston, Partington, Liverpool (Herculaneum Dock).

Rail—North Stafford, Pinnox Junction or Chell Sidings, Tunstall Station.

Canal—Trent and Mersey, Tunstall.

Hard Mine Coal.

Class of Coal—Steam.

	Per cent.
Moisture	4·5
Coke	63·1
Volatile matter	30·2
Ash	2·2
	100·0
Sulphur	0·35

Colour of ash, red grey; calorific power, total units of heat, *i.e.*, pounds of water, heated 1 deg. Cent. by 1 lb. of coal, 8,460; experimental evaporative power of the coal as determined by Thompson's calorimeter, *i.e.*, pounds of water at 100 degs. Cent. converted into steam per 1 lb. of coal, 15·7 lb.

Analyst—Wm. Jas. Orsman.

Date of Analysis—November 1894.

Colliery—WHITFIELD, Holly Lane Seam, Middle Pit.

Holly Lane Coal (Best House-fire Coal).

Class of Coal—House.

	Per cent.
Water expelled at 212 degs. Fahr.	3·4
Volatile hydrocarbons	31·6
Fixed carbon	62·6
Ash	1·6
Sulphur	0·8
	100·0

Percentage of coke in coal	64·2 per cent.
Coke per ton of coal	1,438 lb.
Colour of ash	Light brown

Analyst—Wm. Jas. Orsman.

Date of Analysis—March 16, 1904.

Notes.

Staffordshire.

Colliery—Whitfield, Cockshead Seam, Institute Pit.

Cockshead Coal.

Class of Coal—House and Steam.

	Per cent.
Water expelled at 212 degs. Fahr.	1·7
Volatile hydrocarbons	30·9
Fixed carbon	64·3
Ash	2·5
Sulphur	0·6
	100·0

Percentage of coke	66·8 per cent.
Coke per ton of coal	1,496 lb.
Colour of ash	Light brown
Calorific power	7,947
Experimental evaporative power	14·7 lb.

Analyst—Wm. Jas. Orsman.

Date of Analysis—January 7, 1904.

HAMSTEAD COLLIERY COMPANY LIMITED,

Great Barr, Birmingham.

Colliery—Hamstead, Thick Coal Seam, ... Pit.

Shipping Port— . . . .

Rail—L. and N. W., Great Barr Station.

Canal—Birmingham.

House Coal.

Class of Coal—House.

	Per cent.
Moisture	11·13
Fixed carbon	51·56
Volatile matter	35·81
Ash	1·50
	100·00

Analyst—Wm. Charlton.

Date of Analysis—December 1905.

STAFFORDSHIRE.

Notes.

MIDLAND COAL, COKE AND IRON COMPANY LIMITED,

Newcastle-under-Lyme.

Colliery—PODMORE HALL, Ten-feet Seam, ... Pit.

Shipping Port.—Garston, Liverpool, Birkenhead, Partington, Runcorn, Ellesmere Port, Widnes.

Rail—North Stafford, Newcastle Station, Sidings at Podmore Hall Colliery.

Canal— . . . . . .

Best Ten-feet Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

The general appearance of the coal is shiny black, large, hard, irregular and clean. Shows numerous bright button-like facets. Main fracture irregular, exposing bright shiny back coal, interspersed with soft woody carbon. Cross fracture irregular, bright.

Specific gravity	1·274
Weight of 1 cubic foot	79 63 lb.
Space occupied by 1 ton	28·12 cubic feet
Proximate analysis—	
Moisture	1·03 per cent.
Volatile products	33·07 per cent.
Fixed carbon	63·59 per cent.
Sulphur	1·19 per cent.
Ash	1·12 per cent.
Commercial analysis—	
Gas per ton of coal	11,592 cubic feet
Gas per cubic foot of coal	412 cubic feet
Illuminating power in standard sperm candles	18·62 candles
Value of 1 cubic foot of the gas in sperm	447 grains
Sperm value per ton of coal	740 lb.
Coke per ton of coal (excellent)	12·97 cwt.
Coke per cent. of coal	64·86 per cent.
Ash in the coke (colour, dull brown) ..	1·73 per cent.
Sulphur eliminated with the volatile products	11·37 lb.
Sulphur in the coke	15·38 lb.
Tar per ton of coal	14·83 gallons
Ammonia liquor per ton of coal	22·16 gallons

Analyst—R. O. Paterson.

Date of Analysis—February 24, 1905.

Notes.

STAFFORDSHIRE.

Colliery—APEDALE, Seven-feet Seam, ... Pit.
Shipping Ports— . . . .
Rail— . . . . Railway Sidings at Colliery.
Canal— . . . .

Best Seven-feet Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

The general appearance of the coal is dull black, hard, irregular. Shows small bright shiny facets. Main fracture uneven, exposing bright coal slightly interspersed with soft woody carbon. Cross fracture irregular with traces of carbonate of lime and pyrites.

Specific gravity	1·276
Weight of 1 cubic foot	79·75 lb.
Space occupied by 1 ton	28·08 cubic feet
Proximate analysis—	Per cent.
Moisture	1·28
Volatile products	37·07
Fixed carbon	57·44
Sulphur	2·09
Ash	2·12
	100·00
Commercial analysis—	
Gas per ton of coal	11,662 cubic feet
Gas per cubic foot of coal	415 cubic feet
Illuminating power in standard sperm candles	18·42 candles
Value of 1 cubic foot of the gas in sperm	442 grains
Sperm value per ton of coal	736 lb.
Coke per ton of coal (good)	12·19 cwt.
Coke per cent. of coal	60·94 per cent.
Ash in the coke (colour, dark red) ..	3·48 per cent.
Sulphur eliminated with volatile products	21·21 lb.
Sulphur in the coke	25·53 lb.
Tar per ton of coal	16·25 gallons
Ammoniacal liquor per ton of coal ..	28·60 gallons

Analyst—R. O. Paterson.

Date of Analysis—February 24, 1905.

STAFFORDSHIRE.

Notes.

PARK HALL COLLIERIES LIMITED,

Longton.

Colliery— . . . . Seam, Park Hall Pit.
Shipping Ports—Partington Tips and Herculaneum Docks, Birkenhead
Rail—North Stafford, Weston Coyney Siding.
Canal— . . . . . .

Park Hall Steam Coal.

Class of Coal—Steam.

We have carefully examined the sample of coal you submitted to us on the 29th ult. and now send you the result of our analysis :

Coke assay—	Per cent.
Volatile matter	39·27
Coke	60·73
	100·00

	Per cent.
Fixed carbon	58·17
Volatile matters other than sulphate and water	31·70
Sulphur	0·67
Ash	2·23
Water	7·23
	100·00

Ultimate analysis—	On sample as received. Per cent.	On water-freed sample. Per cent.
Carbon	75·94	81·86
Hydrogen	5·20	5·61
Oxygen	7·58	8·17
Nitrogen	1·15	1·24
Sulphur	0·67	0·72
Ash	2·23	2·40
Water	7·23	—
	100·00	100·00

These results indicate that this is a sample of coal of high-class quality for steam-raising and general purposes. The proportions of volatile matter and coke are very satisfactory, and the percentage of ash and sulphur exceptionally low.

Analysts—A. Norman Tate and Co.
Date of Analysis—February 7, 1894.

Notes.

STAFFORDSHIRE.

Park Hall Gas Coal.

Class of Coal—Gas.

Analysis for gasmaking purposes of sample of coal received from the Park Hall Collieries, Longton, North Staffordshire, May 30, 1894.

The coal contains—	Per cent.	In lb. per ton.
Moisture (given off at 212 degs. F.)	5·64	126·336
Volatile matter (at red heat)	38·24	856·576
Fixed matter (coke and ash)	56·12	1,257·088
	100·00	2,240·000
Containing ash	2·39	53·53
Total sulphur in coal	1·12	25·08
Analysed in a model gas apparatus, $\frac{1}{100}$ ton, or 22·4 lb. of coal, give—		
Tar	12·98	290·625
Ammoniacal liquor, 2·2 degs. Twad., 4·4 oz. strength	14·64	328·120
Containing real ammonia	0·91	20·38
Coke	56·92	1,275·00
Yield of gas per ton (bar. 30 in., temp. 60·0 degs. Fahr.)	10,512·5 cubic feet	
Illuminating power of gas per 5 cubic feet of gas	17·8 standard candles	
Value of gas in sperm	641·5 lb.	
Sulphur in gas after passing through lime purifier, per 100 cubic feet	23·80 grains	

Analyst—Thomas Fairley, F.R.S.E., F.I.C.

Date of Analysis—June 2, 1904.

STAFFORD COAL AND IRON COMPANY LIMITED,

Stoke-on-Trent.

Colliery— . . . . Seam, ... Pit.

Shipping Ports— . . . . . .

Rail— . . . . Station.

Canal— . . . . . .

Great Row Coal.

Class of Coal— . . . . . .

Carbon	71·238 per cent.
Hydrogen	4·977 ,,
Oxygen	11·369 ,,
Nitrogen	1·188 ,,

Staffordshire.

Notes.

Sulphur	1·428 per cent.
Ash	4·100 ,,
Moisture	5·700 ,,
Coke	59·200 ,,
Volatile matter	40·800 ,,
Gas, tar, &c.	34·518 ,,
Fixed carbon	54·254 ,,
Specific gravity	1·317
Weight of 1 cubic foot	82·312 lb.
Heating power (practical)	8·123
Heating power (theoretical)	13·010
Calorific power	12568·100 B.T.U.

Analyst— . . . .

Date of Analysis— . . . . .

Ash Coal.

Carbon	70·040 per cent.
Hydrogen	5·040 ,,
Oxygen..	12·022 ,,
Nitrogen	1·323 ,,
Sulphur	0·485 ,,
Ash	5·600 ,,
Moisture	5·490 ,,
Coke	64·867 ,,
Volatile matter	35·133 ,,
Gas, tar, &c.	29·473 ,,
Fixed carbon	58·952 ,,
Specific gravity	1·297
Weight of 1 cubic foot	81·062 lb.
Heating power (practical)	8·577
Heating power (theoretical)	12·818
Calorific power	12,382·05 B.T.U.

Analyst— . . . .

Date of Analysis— . . . .

Notes.

STAFFORDSHIRE.

TALK-O'-TH'-HILL COLLIERY LIMITED,

Talke, near Stoke-on-Trent.

Colliery—TALK-O'-TH'-HILL, Eight-feet Cockshead Seam, No. 2 Pit.

Shipping Ports—Garston, Liverpool, Runcorn, Widnes, Birkenhead, and ports on Manchester Ship Canal.

Rail—North Stafford, Talk-o'-th'-Hill, *viâ* Chatterley, Station.

Canal— . . . .

Steam Coal.

Class of Coal—Steam.

Chemical analysis—	Per cent.
Water expelled at 212 degs. Fahr.	1·9
Volatile hydrocarbons	31·3
Fixed carbon	64·3
Ash	1·5
Sulphur	1·0
	100·00
Practical results—	Per cent.
Percentage of coke in coal ..	65·8
Coke per ton of coal	1,473
Colour of ash	Brown
Calorific power—	
Total units of heat 8·001	14,402 B.T.U.
Pounds of water at boiling point converted into steam per pound of coal	14·9 lb.

Very pure coal, low in moisture, ash and sulphur.

Analyst—Wm. Jas. Orsman.

Date of Analysis—February 22, 1905.

Colliery—TALK-O'-TH'-HILL, Banbury Seam, No. 2 Pit.

Gas Coal.

Class of Coal—Gas.

Specific gravity	1·262
Weight of 1 cubic foot	78·89 lb.
Space occupied by 1 ton	28·39 cubic feet
Proximate analysis—	Per cent.
Moisture	1·67
Volatile products	35·51
Fixed carbon	60·21
Sulphur	1·25
Ash (colour red)	1·36

STAFFORDSHIRE.

Notes.

Commercial analysis—

Gas per ton of coal	11,595 cubic feet
Gas per cubic foot of coal	408 cubic feet
Illuminating power in standard sperm candles	17·99 candles
Value of 1 cubic foot of the gas in sperm ..	432 grains
Sperm value per ton of coal	715 lb.
Coke per ton of coal (good hard grey) ..	12·23 cwt.
Coke per cent. of coal	61·13 per cent.
Ash in the coke (colour red)	2·22 per cent.
Sulphur eliminated with the volatile products	11·68 lb.
Sulphur in the coke	16·30 lb.
Tar per ton of coal	14·24 gallons
Ammonia liquor per ton of coal	25·90 gallons

Analyst—R. O. Paterson.

Date of Analysis—June 7, 1905.

Notes.

WARWICK.

ARLEY COLLIERY COMPANY LIMITED,

Arley, Coventry.
(Offices: Hall End, Tamworth).

Colliery—ARLEY, Two-yard or Ryder, and "Slate Coal" Seams, Nos. 1 and 2 Pits.

Shipping Port—Lynn.

Rail—Midland, Arley and Fillongley Stations.

Canal—*Nil.*

Two-Yard Coal.

Class of Coal—Household.

	Dried at 212 degs. Fahr. Per cent.	As received. Per cent.
Fixed carbon	60·01	52·70
Volatile hydrocarbons	36·84	32·36
Sulphur	0·85	0·75
Ash	2·30	2·02
Moisture	—	12·17
	100·00	100·00
Sulphur in ash	0·19	0·17
Calorific power by Thompson's calorimeter	13·09 lb.	11·50 lb.
Calorific power, expressed in calories degs. Cent.	7,029	6,175 cal.

Analysts—Pattinson and Stead.

Date of Analysis—June 16, 1905.

Two-yard Spire.

Class of Coal—Steam Coal, Hard, High-class (Locomotive, etc.)

	Dried at 212 degs. Fahr. Per cent.	As received. Per cent.
Fixed carbon	63·50	56·39
Volatile hydrocarbons	33·92	30·12
Sulphur	0·68	0·60
Ash	1·90	1·69
Moisture	—	11·20
	100·00	100·00

WARWICK.

Notes.

Sulphur in ash (per cent.)	0·13	0·12
Calorific power by Thompson's calorimeter	13·36 lb.	11·86 lb.
Calorific power expressed in calories degs. Cent.	7,174	6,369 cal.

Analysts—Pattinson and Stead.

Date of Analysis—June 16, 1905.

Slate Coal.

Class of Coal—Household and Manufacturing,

	Dried at 212 degs. Fahr. Per cent.	As received. Per cent.
Fixed carbon	57·15	51·11
Volatile hydrocarbons	38·51	34·45
Sulphur	1·07	0·96
Ash	3·27	2·93
Moisture	—	10·55
	100·00	100·00
Sulphur in ash	0·29	0·26
Calorific power by Thompson's calorimeter	13·53 lb.	12·10 lb.
Calorific power expressed in calories degs. Cent.	7,266	6,498 cal.

Analysts—Pattinson and Stead.

Date of Analysis—June 16, 1905.

Slate Coal Spire.

Class of Coal—Steam, Hard.

	Dried at 212 degs. Fahr. Per cent.	As received. Per cent.
Fixed carbon	52·23	47·78
Volatile hydrocarbons	40·70	37·23
Sulphur	1·10	1·01
Ash	5·97	5·46
Moisture	—	8·52
	100·00	100·00
Sulphur in ash	0·05	0·05
Calorific power by Thompson's calorimeter	13·31 lb.	12·18 lb.
Calorific power expressed in calories degs. Cent.	7,147	6,541

Analysts—Pattinson and Stead.

Date of Analysis—June 16, 1905.

Notes.

WARWICK.

GRIFF COLLIERY COMPANY,

Nuneaton.

Colliery—GRIFF, Slate-Coal, Two-yard, and Seven-feet Seam, ... Pit.

Shipping Port— . . . .

Rail—L. and N. W. and Midland, Nuneaton Station.

Canal—Coventry.

Griff Steam Coal.

Class of Coal—Hand-picked Steam.

	Per cent.
Fixed carbon	49·65
Volatile matter	38·25
Ash	2·15
Moisture	9·95
	100·00

Sulphur	0·33 per cent.
Calorific value in British thermal units	11·913
Evaporative power	12·32 lb.

Analyst—Bostock Hill.

Date of Analysis—July, 1905.

NEWDIGATE COLLIERY LIMITED,

Bedworth, Nuneaton.

Colliery—NEWDIGATE, Two Yard Seam, ... Pit.

Shipping Port— . . . . . .

Rail—L. and N. W. and Midland, Bedworth Station.

Canal—Coventry.

Two Yard Coal.

Class of Coal—House.

Moisture	8·5 per cent.
Sample dried at 212 degs. Fahr.—	
Volatiles	37·93 per cent.
Fixed carbon	59·83 per cent.
Ash	2·24 per cent.
	100·00
Specific gravity	1·3

Notes.

WARWICK.

Ultimate analysis—	Per cent.
Carbon	79·860
Hydrogen	5·340
Oxygen	10·528
Nitrogen	1·287
Sulphur	0·745
Ash	2·240
	100·000

Remarkably free from pyrites. Non-caking. Bituminous.

Analyst—Major Brunner.
Date of Analysis—1904.

Colliery—NEWDIGATE, Nine-foot Seam, ... Pit.

Nine-foot Coal.

Class of Coal—Steam.

Chemical analysis—	Per cent.
Water expelled at 212 degs. Fahr.	7·1
Volatile hydrocarbons	37·6
Fixed carbon	50·6
Ash	3·9
Sulphur	0·8
	100·0

Percentage of coke in coal	54·5 per cent.
Coke per ton of coal	1,220 lb.
Colour of ash	Grey white
Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	12,280 cubic feet
Illuminating power of gas in standard candles	16 candles
Character of the coke	Short and brittle
Calorific power—	
Total units of heat, *i.e.*, pounds of water heated 1 deg. Fahr. by 1 lb. of coal ..	11,400 lb.

Experimental evaporative power of the coal, as determined by the calorimeter:—Pounds of water at boiling point converted into steam per 1 lb. of coal, 11·8 lb.

Analyst—J. W. Orsman.
Date of Analysis—1904.

Notes.

YORKSHIRE.

BARNSLEY MAIN COLLIERY COMPANY LIMITED,

Barnsley.

Collieries—BARNSLEY MAIN and OLD OAKS, ... Seam, ... Pit.

Shipping Ports—Hull, Grimsby, Goole, Keadby, Partington.

Rail—Great Central and Midland, Stairfoot Station.

Canal—South Yorkshire Navigation.

Lidgett Gas Coal.

Class of Coal—Gas.

Gas per ton of coal	11,428 cubic feet
Gas per cubic foot of coal	411 cubic feet
Illuminating power in standard sperm candles	17·85 candles
Value of 1 cubic foot in sperm	427 grains
Sperm value per ton of coal	699 lb.
Coke per ton of coal	1,418 lb.
Coke per cent. of coal	63·3 per cent.
Ash in coke	3·73 per cent.
Sulphur eliminated with the volatile products	26·45 lb.
Sulphur in coke	24·30 lb.
Tar per ton of coal	18·29 gallons
Liquor	21·29 gallons

Analyst—R. O. Paterson.

Date of Analysis—February 20, 1901.

Ardsley Gas Coal.

Class of Coal—Gas.

Gas per ton of coal	11,428 cubic feet
Gas per cubic foot of coal	411 cubic feet
Illuminating power in standard sperm candles	19·59 candles
Value of 1 cubic foot in sperm	470 grains
Sperm value per ton of coal	767 lb.
Coke per ton of coal	1,462 lb.
Coke per cent. of coal	65·3 per cent.
Ash in coke	4·96 per cent.
Sulphur eliminated with the volatile products	13·54 lb.
Sulphur in coke	14·76 lb.
Tar per ton of coal	14·83 gallons
Liquor	31·50 gallons

Analyst—R. O. Paterson.

Date of Analysis—February 20, 1901.

Notes.

YORKSHIRE.

BOLCKOW, VAUGHAN AND CO. LIMITED,

Middlesbrough.

Collieries—DEAN AND CHAPTER, LEASINGTHORNE, and AUCKLAND PARK, Brockwell Seam, ... Pit.

Shipping Ports—Middlesbrough Dock, West Hartlepool, Tyne Dock, Dunston.

Rail—Colliery Sidings.

Canal— . . . . . .

Brockwell Screened Coal.

Class of Coal—Steam.

	First sample. Dried at 212 F. Per cent.	As received. Per cent.
Fixed carbon	67·67 ..	66·32
Volatile hydrocarbons	28·37 ..	27·81
Sulphur	·86 ..	·84
Ash	3·10 ..	3·04
Moisture	— ..	1·99
	100·00	100·00
Calorific power expressed in calories	8,271 ..	8,106
	Second sample. Per cent.	Per cent.
Fixed carbon	65·33 ..	64·01
Volatile hydrocarbons	31·00 ..	30·37
Sulphur	·64 ..	·63
Ash	3·03 ..	2·97
Moisture	— ..	2·02
	100·00 ..	100·00
Calorific power	8,350 ..	8,181

Analysts—Pattinson and Stead.

Date of Analysis—November, 1907.

Notes.

YORKSHIRE.

Colliery—NEWFIELD, ... Seam, ... Pit.

Newfield Gas Coal.

Class of Coal—Gas.

	Per cent.
Fixed carbon	63·88
Volatile hydrocarbons	30·78
Sulphur	1·20
Ash	3·50
Moisture	0·64
	100·00
Sulphur in ash	0·04
Yield of coke	68·00
Yield of gas per ton of coal	10,860 cubic feet
Illuminating power of gas	16·9 candles
Light given by gas from 1 ton of coal when distilled	629·3 lb. standard sperm candles

Analysts—Pattinson and Stead.

Date of Analysis—June 6, 1891.

Colliery—BINCHESTER, ... Seam, ... Pit.

Binchester Gas Coal.

Class of Coal—Gas.

	Per cent.
Fixed carbon	61·47
Volatile hydrocarbons	29·93
Sulphur	1·42
Ash	6·50
Moisture	0·68
	100·00
Sulphur in ash	0·14
Yield of coke	68·75
Yield of gas per ton of coal	10,300 cubic feet
Illuminating power of gas	17·3 candles
Light given by gas from 1 ton of coal when distilled	610·9 lb. standard sperm candles

Analysts—Pattinson and Stead.

Date of Analysis—June 6, 1891.

Notes.

YORKSHIRE.

Colliery—AUCKLAND PARK, ... Seam, ... Pit.

Wood's Harvey Gas Coal.

Class of Coal—Gas.

	Per cent.
Fixed carbon	64·59
Volatile hydrocarbons	29·51
Sulphur	0·79
Ash	3·75
Moisture	1·36
	100·00
Sulphur in ash	0·02
Yield of coke	68·75
Yield of gas per ton of coal	10,800 cubic feet
Illuminating power of gas	17·6 candles
Light given by gas from 1 ton of coal when distilled	651·7 lb. standard sperm candles

Analysts—Pattinson and Stead.
Date of Analysis—June 6, 1891.

Colliery—DEAN AND CHAPTER, Harvey Main and Five-quarter Seams.

Tees Wallsend House Coal.

Class of Coal—House.

	First sample.	
	Dried at 212 F. Per cent.	As received. Per cent.
Fixed carbon	60·16	59·38
Volatile hydrocarbons	34·86	34·40
Sulphur	1·48	1·46
Ash	3·50	3·45
Moisture	—	1·31
	100·00	100·00
Calorific power	8,265	8,157
	Second sample.	
	Per cent.	Per cent.
Fixed carbon	63·51	61·17
Volatile hydrocarbons	34·00	32·75
Sulphur	·89	·86
Ash	1·60	1·54
Moisture	—	3·68
	100·00	100·00
Calorific power	8,247	7,944

The calorific power was determined in each case in Cook Mahler bomb.

Analysts—Pattinson and Stead.
Date of Analysis—November, 1907.

Notes.

YORKSHIRE.

T. AND R. W. BOWER LIMITED,

Woodlesford, near Leeds.

Colliery—ALLERTON MAIN, Middleton Main Seam, Albert Pit.
Shipping Ports—Hull, Goole.
Rail—North Eastern, Kippax Station.
Canal—Aire and Calder.

Silkstone Gas Coal.

Class of Coal—Gas.

Yield of gas per ton of coal	11,200 cubic feet
Illuminating power	16 std. candles
Yield of coke per ton of coal	1,305 lb.
Ash in coke	6·3 per cent.
Specific gravity of coal	1·262
Value of 1 cubic foot in sperm	384 grains
Value of gas per ton of coal	614·3 lb. sperm
Sulphur	1·173 per cent.

Analyst—James Paterson, C.E., F.G.S.
Date of Analysis—April 13, 1880.

Allerton Main Cannel Coal.

Class of Coal— . . . . . .

Yield of gas per ton of coal	11,500 cubic feet
Illuminating power	19 std. candles
Coke per ton of coal	1,209 lb.
Ash in coke	7 per cent.
Value of 1 cubic foot in sperm	456 grains
Value of gas per ton of coal	749·14 lb. sperm

Analyst—James Paterson, C.E., F.G.S.
Date of Analysis—April 13, 1880.

YORKSHIRE.

Notes.

HENRY BRIGGS, SON AND CO. LIMITED,

Whitwood, Normanton.

Colliery—WHITWOOD, ... Seam, Don Pedro and Savile Pits.

Shipping Ports—Hull, Goole.

Rail— . . . . Station.

Canal— . . . .

Stanley Main Steam Coal.

Class of Coal—Steam.

	Per cent.
Carbon	73·64
Hydrogen	4·80
Oxygen	9·09
Nitrogen	1·19
Sulphur	1·18
Ash	2·81
Water	7·29
	100·00
Coke..	58·9
Volatile matter	41·1
	100·0

Calorific power: Water evaporated by 1 lb. of the coal, as determined by Thomson's calorimeter, 13 lb.

Analyst—John Pattinson.

Date of Analysis— . . . .

Colliery—WHITWOOD, ... Seam, Silkstone Pit.

Silkstone Gas Coal (Whitwood).

Class of Coal—Gas.

Yield of gas per ton of coal	11,000 cubic feet
Illuminating power	18·1 std. sperm candles

	Per cent.
Coke..	59·5
Volatile matters	40·5
	100·0

The coal cokes well, and the resulting coke is of good quality.

Notes

YORKSHIRE.

Silkstone Gas Coal (Whitwood)—*cont.*

Complete ultimate analysis of the coal—

	Per cent.
Carbon	75·65
Hydrogen	4·71
Oxygen	9·31
Nitrogen	1·86
Sulphur	1·94
Ash	2·50
Water	4·03
	100·00

The above results show that this is an excellent coal for gas-making purposes.

Analyst—John Pattinson.

Date of Analysis— . . . .

JOHN BROWN AND CO. LIMITED,

Atlas Works, Sheffield.

Collieries—ALDWARKE MAIN, CAR HOUSE, and ROTHERHAM MAIN, Parkgate Gas Coal Seam, Parkgate Pit.

Shipping Ports—Hull, New Holland, Grimsby, Keadby, Liverpool, Widnes, Garston, Partington, and other Manchester Ship Canal Ports.

Rail—Midland, Great Central, Rotherham Station.

Canal—(Aldwarke Main Colliery), Sheffield and South Yorkshire Navigation.

Aldwarke Main Gas Coal.

Class of Coal—Gas.

Specific gravity of coal (water as 1)	1·266
Weight of 1 cubic foot	78·884 lb.
Sulphur	0·300 per cent.
Purified gas per ton of coal	12,600 cubic feet
Matters condensable by bromine	2·25 per cent.
Illuminating power of gas consumed in a London standard Argand, at the rate of 5 cubic feet per hour, in sperm candles, of 120 grains	19·00 candles
Value of 1 cubic foot in sperm	456·200 grains
Weight of illuminating matter in sperm ..	820·80 lb.
Weight of coke per ton of coal	1,428 lb.

Notes.

YORKSHIRE.

Analysis of coke—

	Per cent.
Fixed carbon	96·10
Ash	3·90

Analyst—James Paterson.

Date of Analysis—May 9, 1879.

The above analysis was made as long ago as 1879, but with a view to confirming (or otherwise) those results further tests have been made of the entire seam of coal, and also of several sections of the seam. The first results have been improved upon, although as compared with 1879 the present workings are nearly two miles further distant from the shaft.

Entire Seam as Wrought in the Pit.

Specific gravity of coal (average)	1·267
Weight of 1 cubic foot	79·18 lb.
Sulphur in coal	0·37 per cent.
Average weight of sulphur per ton of coal ..	8·29 lb.
Purified gas per ton of coal	12,900 cubic feet
Gas per cubic foot of coal	465 cubic feet
Illuminating power of gas consumed in a London standard Argand	18·63 sperm candles
Value of 1 cubic foot in grains of sperm ..	447·15 grains
Weight of illuminating matter	822·60 lb. sperm
Weight of coke per ton of coal	1,414 lb.
Percentage of coke per ton of coal	63·12 per cent.
Coke analysis :—	Per cent.
Fixed carbon	95·70
Ash	4·30

Analyst—James Paterson.

Date of Analysis—April 30, 1891.

Dull Hards (average of tests)

Specific gravity of coal (water as 1)	1·281
Weight of 1 cubic foot	80 lb.
Sulphur	0·437 per cent.
Weight of sulphur per ton of coal	6·72 lb.
Purified gas per ton of coal	12,050 cubic feet
Gas, in cubic feet, per cubic foot of coal ..	430·36 cubic feet
Illuminating power	20·16 candles
Value of 1 cubic foot in sperm	443·44 grains
Weight of illuminating matter in sperm ..	832·21 lb.
Yield of coke per ton of coal, 1,420 lb. or ..	63·37 per cent.
Analysis of coke—	Per cent.
Fixed carbon	95·70
Ash	4·30

Analyst—J. Paterson.

Dates of Analyses—May 9, 1879; April 30, 1891; March 23, 1893.

Notes.

YORKSHIRE.

Bright Hards (average of tests).

Specific gravity of coal (water as 1)	1·291
Weight of 1 cubic foot	80·68 lb.
Sulphur in coal	0·30 per cent.
Weight of sulphur per ton of coal	6·72 lb.
Purified gas per ton of coal	12,200 cubic feet
Gas per cubic foot of coal	439·47 cubic feet
Illuminating power of gas (consumed in a London standard Argand)	19·83 sperm candles
Value of 1 cubic foot in sperm	475·92 grains
Weight of illuminating matter in sperm	829·46 lb.
Weight of coke per ton of coal	1,400 lb.
Percentage of coke per ton of coal	62·50 per cent.
Analysis of coke—	Per cent.
Fixed carbon	96·70
Ash	3·30

Analyst—James Paterson.

Dates of Analyses—May 9, 1879; April 30, 1891; March 21, 1893.

Bright Softs (average of tests).

Specific gravity of coal (water as 1)	1·267
Weight of 1 cubic foot	79·29 lb.
Sulphur in the coal	0·38 per cent.
Weight of sulphur per ton of coal	8·51 lb.
Purified gas per ton of coal	11,750 cubic feet
Gas per cubic foot of coal	415·78 cubic feet
Illuminating power of gas	19·71 sperm candles
Value of 1 cubic foot in sperm	473·04 grains
Weight of illuminating matter in pounds sperm	794·03 lb.
Weight of coke per ton of coal	1,368 lb.
Yield of coke	60·71 per cent.
Coke analysis—	Per cent.
Fixed carbon	95·20
Ash	4·80

Analyst—James Paterson.

Dates of Analyses—May 9, 1879; April 30, 1891; March 21, 1893.

Yorkshire.

Notes.

J. AND J. CHARLESWORTH LIMITED,

Wakefield.

Colliery—Rothwell Haigh, ... Seam, Beeston Pit.

Shipping Ports—Hull, Goole.

Rail—Midland, E. and W. Yorkshire Union, Rothwell Station, Haigh Sidings.

Canal—Aire and Calder.

Beeston Nuts Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

	Per cent.		Lb. per ton of coal.
Moisture (given off at 220 degs. Fahr.)	4·33	..	97·00
Volatile matter (given off at red heat)	32·39	..	725·53
Coke	60·42	..	1,353·41
Ash	2·86	..	64·06
	100·00	..	2,240·00
Tar	4·19	..	94·00
Ammoniacal liquor (3 degs. Twaddell = 6 oz. liquor)	7·81	..	175·00
Containing real ammonia	0·10	..	2·28
Coke	61·66	..	1,380·00

Gas per ton of coal	11,750 cubic feet
Illuminating power of the gas per 5 cubic feet of gas	19 standard candles
Sulphur in gas after passing through lime, per 100 cubic feet	14·25 grains

Analyst—Thomas Fairley.

Date of Analysis—September 22, 1884.

Notes.

YORKSHIRE.

JAS. CRITCHLEY AND SONS LIMITED,

West End Collieries, Batley.

Colliery—WEST END, Batley.

Shipping Ports—Hull and Goole.

Rail—West End Sidings, Batley, L. and N. W.

West End Black Bed Coal.

Class of Coal—Gas.

Specific gravity	1·300
Purified gas per ton	11,500 cubic feet
Value of 1 cubic foot in sperm	428·88 grains
Value of gas per ton of coal in sperm	704·59 lb.
Illuminating power of gas	17·87 std. candles
Coke per ton	1,437 lb.
Coke	64·15 per cent.
Fixed carbon in coke	92·5 per cent.
Ash in coke..	7·5 per cent.
Sulphur in coal	2·77 per cent.

Analysts—Thos. Newbigging and Son.

Date of Analysis—September 14, 1903.

West End Beeston Gas Coal.

Class of Coal—Gas.

Specific gravity	1·290
Purified gas per ton	11,150 cubic feet
Value of one cubic foot in sperm	476·16 grains
Value of gas per ton of coal in sperm	758·74 lb.
Illuminating power of gas	19·84 std. candles
Coke per ton	1,500 lb.
Coke	66·96 per cent.
Fixed carbon in coke	90 per cent
Ash in coke	10 per cent.
Sulphur in coal	2·08 per cent.

Analysts—Thos. Newbigging and Son.

Date of Analysis—September 14, 1903.

YORKSHIRE.

Notes.

DALTON MAIN COLLIERIES LIMITED,

Park Gate, Rotherham.

Colliery— . . . . Barnsley Seam, Silverwood and Roundwood Pits.

Shipping Ports—Hull, Goole, Grimsby, Keadby, Liverpool, Manchester Ship Canal, Boston.

Rail—Midland and Great Central Railways, Rawmarsh (Midland), Aldwarke (Great Central) Stations.

Canal—Sheffield and South Yorkshire Navigation.

Dalton Main Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

Hard Steam Coal—	Per cent.
Fixed carbon	62·95
Volatile hydrocarbons	35·28
Sulphur	0·63
Ash	2·46
Moisture	0·68
	100·00
Sulphur in ash	0·02
Calorific power expressed in calories (C.)	7,977

Equal to 14·85 lb. of water evaporated by 1 lb. of coal.

Best gas coal—

Yield of gas per ton of coal	11,760 cubic feet
Illuminating power of gas	16·10 std. sp. candles
Light given by gas from 1 ton of coal, when distilled, equal to	649·15 std. sp. candles
Yield of coke per ton of coal	12·66 cwt.
Ash in coke	2·12 per cent.

Analysts—Pattinson and Stead.

Date of Analysis—July, 1904.

Notes.

YORKSHIRE.

DEARNE VALLEY COLLIERY COMPANY LIMITED,

Little Houghton, near Barnsley.

Colliery—DEARNE VALLEY, Shafton Seam, Dearne Valley Pit.
Shipping Ports—Keadby, Goole, Hull, Grimsby, Partington, &c.
Rail—Midland, Darfield Station.
Canal— . . . . . .

Dearne Valley Coal.

Class of Coal—Steam, Manufacturing House.

	Per cent.
Ash	2·00
Sulphur	1·36
Volatile matter (including moisture expelled at 212 degs. Fahr., 8·44 per cent.)	45·45
Fixed carbon (by difference)	51·19
	100·00

Pounds of water evaporated from 212 degs. Fahr. by 1 lb. of the coal (determined by Lewis Thomson's calorimeter)	13·86 lb.
Equals British thermal units	13,397 B.T.U.

Analyst—Wm. McD. Mackey.
Date of Analysis—May 25, 1904.

DENABY AND CADEBY MAIN COLLIERIES LIMITED,

Doncaster.

Colliery—DENABY AND CADEBY MAIN, Barnsley Thick Seam, Denaby and Cadeby Pits.
Shipping Ports—Liverpool, Manchester Ship Canal, Hull, Grimsby, Goole, etc.
Rail—Great Central, Lancs. and Yorks., and Hull and Barnsley, Conisbro' Station.
Canal—South Yorkshire Navigation.

Denaby and Cadeby Main Washed Singles.

Class of Coal—Steam, Manufacturing.

This coal was tested in practical use during 1903 and 1904 by an important manufacturing firm in London, when the following results were obtained :—

YORKSHIRE.

Notes.

Ten well-known South Wales coals showed an average evaporative power of 9·34 lb. of water per pound of coal used.

Denaby and Cadeby Main washed singles showed an evaporative power of 9·50 lb. of water per pound of coal used.

The saving in favour of the Denaby and Cadeby Main washed singles being £593 per annum.

Analyst— . . . . . .

Date of Analysis— . . . . . .

Washed Small Coal.

Class of Coal—Steam, Manufacturing.

	Per cent.
Ash	2·18
Sulphur	0·86
Volatile carbonaceous matter ..	36·09
Fixed carbon	56·69
Total combustible matter ..	92·78

The calorific value was determined in pounds of water evaporated from 212 degs. Fahr. by 1 lb. of the slack, and found to be 14·10 lb. This is a very good slack, both as regards lowness in ash and calorific value.

Analysts—Hunt and Mackey.

Date of Analysis—January 15, 1891.

In the sixty samples of Denaby and Cadeby washed coal submitted to me during the past four years, I find the average percentage of ash to be 2·26.

Analyst—Wm. McD. Mackey.

Date of Analysis—March 27, 1896.

Notes.

YORKSHIRE.

Denaby and Cadeby Main Washed Small Coal.

Class of Coal—Steam, Manufacturing.

This sample was black and bright; burnt freely with much flame. Ash, brown. Specific gravity, 1·290. One cubic foot weighs 80·4 lb.

Sample dried at 100 degs. Cent.

	Per cent.
Carbon	80·11
Hydrogen	5·13
Oxygen and nitrogen	11·76
Sulphur	0·79
Ash	2·21
	100·00
Coke..	63·7
Calorific value (Thompson's calorimeter)	14·3 per cent.

This is a very good clean coal, contains very small amount of ash, and is high in carbon and calorific value.

I may add that I have determined the ash in 27 samples of this washed coal during the last 12 months, and the average ash is 2·204 per cent., the figures varying very little during this period. I consider this an excellent coal for engine purposes or gas making.

Analyst—C. K. Baker, A.R.S.M., F.I.C.

Date of Analysis—June 1, 1893.

I find I have determined the ash in 189 samples of Denaby and Cadeby washed singles coal from 1892 to the present date, and the average ash of these samples is 2·716 per cent.

Analyst—C. K. Baker.

Date of Analysis—September 30, 1904.

Denaby and Cadeby Main Washed Gas Coal.

Class of Coal—Gas.

Treated in gas-making plant—

Illuminating gas per ton of coal	10,640 cubic feet
Illuminating power of gas	17·2 std. candles
Value in sperm	627·4 lb.
Coke	63·28 per cent.
Total gas capable of being given off in Siemens type of gas producer	131,643 cubic feet

YORKSHIRE.

Notes.

This is an excellent coal for use in Siemens type of gas-producer, and for metallurgical purposes generally. The sulphur and ash are very low, and the heating power is great.

It is also quite suitable for manufacture of illuminating gas.

Analyst—C. K. Baker, A.R.S.M., F.I.C.

Date of Analysis—July 27, 1901.

Denaby and Cadeby Double-screened Gas Nuts.

Class of Coal—Gas, House.

	Per cent.
Moisture	3·63
Coke	61·40
Ash	2·15
Sulphur	0·74

Yield of gas per ton of coal, when treated in small gas-making plant	10,080 cubic feet
Illuminating power of gas when burnt at 5 cubic feet per hour in London standard Argand burner	16·8 standard candles
Total gas capable of being driven off in Siemens type of gas producer, per ton ..	129,440 cubic feet

The sample was clean and perfectly free from smudge. Specific gravity, 1·269. The analysis shows it to be a very good coal for gas-making, and very suitable for burning in Siemens producer furnaces, on account of its small amount of ash and sulphur.

Analyst—C. K. Baker, A.R.S.M., F.I.C.

Date of Analysis—December 19, 1892.

Denaby and Cadeby Main Washed Steam Coal for Steamers' Use.

Class of Coal—Steam.

Specific gravity	1·281
	Per cent.
Fixed carbon	60·45
Volatile matter	33·46
Ash	2·83
Moisture	3·26
	100·00
Sulphur	0·78

Calorific value (in pounds of water at 100 degs. Cent. which 1 lb. of coal will evaporate) by Thompson's calorimeter 14·6, equals 7,840 calories.

Analyst—C. K. Baker, A.R.S.M., F.I.C.

Date of Analysis—July 27, 1901.

Notes.

YORKSHIRE.

Best South Yorkshire Hard Steam Coal.

Class of Coal—Steam.

Sample taken from bulk of cargo at Oxelosund.

	Per cent.
Volatile carbonaceous matter ..	32·85
Fixed carbon (ash free)	64·56
Ash	2·59
	100·00
Sulphur	0·90

Calorific heating power, 8,120 calories.

Analyst—Kemiskt Tekniska Bryän, per John Landin.

Date of Analysis—Stockholm, January 27, 1900.

Denaby and Cadeby Main Hard Steam Coal.

Class of Coal—Steam.

	Per cent.
Coke	62·83
Volatile matter	37·17
Ash	3·64
Ultimate analysis:—	
Carbon	77·39
Hydrogen	4·81
Oxygen	9·14
Nitrogen	1·59
Sulphur	0·59
Ash	3·64
Moisture	2·84

The coal is bituminous; the coke is hard and dense, and has a metallic ring; the ash is light grey.

Calorific power of coal	14,314 B.T.U.
Evaporative power of coal	14·80 lb.

Analyst— . . . .

Date of Analysis—December 16, 1904.

YORKSHIRE.

Denaby and Cadeby Main Hard Steam Coal.

Class of Coal— . . . . . .

Our chemist has finished the analysis of your sample of hard coal. He says it is a very good coal, and does not remember having had a better for analysis. I give you below details :—

	Per cent.
Carbon	77·05
Sulphur	0·60 (very low)
Ash	3·70
Moisture	3·17
Evaporative power	13·17 lb.
Calorific power (determined by Thompson's calorimeter)	13335·0 cal.

Analyst— . . . .

Date of Analysis—December 8, 1904.

Extract from report on coal selected and analysed by Professor Hy. Louis of Durham, for the Swedish Iron Masters, 5th July, 1899.

Denaby Main Hards.

Class of Coal—Steam.

Complete analysis on dried substance—

	Per cent.	Per cent.
Moisture	2·1	2·9
Carbon	81·6	81·2
Hydrogen	5·4	5·2
Nitrogen	1·47	1·58
Oxygen	5·92	6·29
Sulphur	1·61	1·63
Ash	4·0	4·1
	100·00	100·00
Caloric value in bomb calories	8,210	8,190

Estimating analysis—

	Per cent.	Per cent.
Coke	64·5	64·9
Volatile matter	29·4	28·1
Moisture	2·1	2·9
Ash	4·0	4·1

Remarks about the quality of coke. The appearance of the ash &c. :—Flame, long ; coke, firm ; ash, grey, yellow.

Analyst—Professor H. Louis.

Date of Analysis—July 5, 1899.

Notes.

YORKSHIRE.

Mr. HENRY ELLISON,

Cleckheaton.

Colliery—WHITEHALL, Low Bed Seam, ... Pit.
Shipping Ports—Goole, Manchester.
Rail—Lancs. and Yorks, Wyke and Cleckheaton Stations.
Canal— . . . .

Low Moor Cannel.

Class of Coal—Gas.

The coal contains—	Per cent.	Lb. per ton.
Moisture (given off at 212 degs. Fahr.)	1·05	23·52
Volatile matter (at red heat)	41·15	921·76
Fixed matter (coke and ash)	57·80	1,294·72
	100·00	2,240·00
Containing ash	15·39	344·736
Total sulphur in coal	2·72	60·928

Analysed in a model gas apparatus, one-hundredth ton, or 22·4 lb. of coal, give :—

	Per cent.	Lb. per ton.
Tar	14·92	334·37
Ammoniacal liquor, 1·82 degs. Twaddell, 3·64 oz. strength	5·44	121·87
Containing real ammonia	0·78	17·472
Coke	58·87	1,318·75
Cubic feet of gas per ton (bar. 30 in., temperature 60·0 degs. Fahr.)		11,285 cubic ft.
Illuminating power of gas in standard candles per 5 cubic feet of gas		25·9 standard candles
Giving value of gas in sperm		1,002·1 lb.
Sulphur in gas after passing through lime purifiers in grains per 100 cubic feet		20·03 grains

Analyst—Thomas Fairley.

Date of Analysis— . . . .

Notes.

YORKSHIRE.

THE RIGHT HON. EARL FITZWILLIAM,

Elsecar, near Barnsley.

Colliery—ELSECAR, Barnsley Seam, Elsecar and Low Stubbin Pits.

Shipping Ports—Hull, Grimsby, Goole, Liverpool, Manchester, etc.

Rail—Great Central, Midland, Elsecar, Rotherham Road, and Masboro' Stations.

Canal—South Yorkshire Navigation.

Elsecar Best Hard Steam Coal.

Class of Coal—Steam.

Analysis—	Per cent.
Carbon	79·40
Hydrogen	4·58
Oxygen and nitrogen	8·20
Ash	3·04
Water	4·22
Sulphur	0·56
	100·00

This is a hard steam coal of the best quality, the percentage of carbon is high, and the amount of ash left after combustion is unusually low. The coal also contains only a very small amount of sulphur.

Analyst—C. A. Bothamley, F.C.S.

Date of Analysis—June 1, 1884.

S. FOX AND COMPANY LIMITED,

Stockbridge, near Sheffield.

Colliery—STOCKBRIDGE, Halifax Seam, ... Pit.

Shipping Port—None.

Rail—Great Central, Deepcar Station.

Canal—None.

Halifax Soft Coal, Halifax Hard or Ganister Coal.

Class of Coal—Manufacturing.

Analysis—	Halifax Soft Coal. Per cent.	Halifax Hard or Ganister Coal. Per cent.
Fixed carbon	60·83	47·19
Volatile hydrocarbons	32·52	37·00
Sulphur	0·90	5·26
Ash	4·97	7·00
Water	0·78	3·55
	100·00	100·00

Analyst—R. Harris.

Date of Analysis—April 2, 1906.

Notes.

YORKSHIRE.

OWNERS OF GARFORTH COLLIERY,

Garforth, near Leeds.

Colliery—GARFORTH, Beeston Seam, Isabella and Sisters Pits.
Shipping Ports—Hull, Goole.
Rail—North Eastern, Garforth Station.
Canal—None.

Beeston Best Coal.

Class of Coal—Steam, Manufacturing, House.

	Per cent.	Lb. per ton.
Moisture	8·75	196·00
Volatile matter	34·37	769·89
Coke	55·95	1253·28
Ash	0·93	20·83
	100·00	2240·00
Total sulphur in coal	0·83	18·59

Analyst—Thomas Fairley.
Date of Analysis—April 28, 1885.

GLASS HOUGHTON AND CASTLEFORD COLLIERIES LIMITED,

Castleford.

Colliery—GLASS HOUGHTON, Silkstone Seam, No. 1 Pit.
Shipping Ports—Goole, Hull.
Rail—Lancs. and Yorks., North Eastern, Castleford Station.
Canal—None.

Silkstone Gas Coal.

Class of Coal—Gas.

	No. 4a Screened.	No. 8's 1½ in. Gas Nuts.	⅓ No. 17's Large Screened Coal. ⅔ No. 10's Rough Slack.	½ No. 4's Large Unscreened. ½ No. 10's Rough Slack.
Cubic feet of gas per ton of coal	10,500	10,300	10,000	10,200
Illuminating power as ascertained by burning the gas, rate at 5 cubic feet per hour, with No. 1 London Argand standard burner, sperm candle	17·4	17·1	17·7	17·6
Illuminating value per ton in pounds sperm	626	604	607	615

YORKSHIRE.

Percentage of coke and volatile matters :—	Per cent.	Per cent.	Per cent.	Per cent.
Non-volatile matters (coke)	62	.. 61·8	.. 62·5	.. 61·8
Volatile matters, including water, expelled at a red heat in a closed vessel ..	38	.. 38·2	.. 37·5	.. 38·2
	100	.. 100·0	.. 100·0	.. 100·0
Complete "ultimate" analyses of the coals were made and the following results were obtained :—				
Carbon	74·24	.. 73·92	.. 73·41	.. 73·16
Hydrogen	4·83	.. 4·86	.. 4·86	.. 4·80
Oxygen	7·08	.. 8·03	.. 7·41	.. 7·41
Nitrogen	1·50	.. 1·46	.. 1·37	.. 1·61
Sulphur	1·70	.. 1·87	.. 1·80	.. 1·34
Ash	5·68	.. 4·98	.. 6·34	.. 6·56
Water	4·97	.. 4·88	.. 4·81	.. 5·12
	100·00	.. 100·00	.. 100·00	.. 100·00
Burnt in Thompson's calorimeter— Pounds of water evaporated from 212 degs. Fahr. by 1 lb. of the coal	13·7	.. 13·6	.. 13·5	.. 13·3

These are very good coals for gas-making purposes.

Analysts—J. and H. S. Pattinson.

Date of Analysis—May 27, 1904.

Colliery—GLASS HOUGHTON, Flockton Seam, No. 1 Pit.

(1) "Tops," (2) "Bottoms."

Class of Coal—Gas.

The coals were submitted to distillation in a coal-testing apparatus at a temperature of 1,000 degs. Cent., and the gas yielded was measured. This gas was burnt in a photometer fitted with the No. 1 London Argand standard burner, at such a rate as to give the maximum efficiency of illumination; the illuminating power was determined, and the proportionate illuminating power at the standard rate of consumption of 5 cubic feet per hour was calculated from the results :—

Notes.

YORKSHIRE.

(1) "Tops," (2) "Bottoms"—*cont.*

	(1) Tops.	(2) Bottoms.
Yield of gas per ton of coal	10,500 ..	10,500 cub. ft.
Illuminating power of the gas ..	16·4 ..	15·7 std. candles
Illuminating value of gas expressed in sperm per ton of coal	590 lb. ..	565 lb.

The coals yielded the following percentage amounts of coke and volatile matters :—

	Tops. Per cent.	Bottoms. Per cent.
Non-volatile matters (coke)	60·8 ..	60·8
Volatile matters, including water, expelled at 1,000 degs. Cent. in a closed vessel	39·2 ..	39·2
	100·0	100·0

A complete ultimate analysis was made of each coal, and the following results were obtained :—

	Tops. Per cent.	Bottoms. Per cent.
Carbon	73·36 ..	71·62
Hydrogen	4·80 ..	4·57
Oxygen	8·36 ..	7·21
Nitrogen	1·34 ..	1·24
Sulphur	1·37 ..	2·81
Ash	5·60 ..	6·64
Water	5·17 ..	5·91
	100·00	100·00

The calorific powers of the samples were also determined, and the following results were obtained :—

	Tops.	Bottoms.
Pounds of water evaporated from 212 degs. Fahr. by 1 lb. of the coal ..	13·4 ..	13·1

These are both gas coals of good quality.

Analysts—J. and H. S. Pattinson.

Date of Analysis—November 14, 1905.

Notes.

YORKSHIRE.

Colliery—GLASS HOUGHTON, Blocking Coal Seam, No. 1 Pit.

"Blocking" Coal.

Class of Coal—Gas.

On submitting the coal to distillation in a coal-testing apparatus, 10,500 cubic feet of gas were obtained per ton of coal, having an illuminating power equal to 15·8 standard sperm candles as ascertained by burning the gas at the rate of 5 cubic feet per hour in a photometer fitted with the No. 1 London Argand standard burner. The illuminating value of the coal per ton expressed in pounds of sperm is 569.

The coal yielded the following percentage amounts of coke and volatile matters :—

	Per cent.
Non-volatile matters	62·5
Volatile matters, including water expelled at a red heat in a closed vessel	37·5
	100·0

A complete ultimate analysis of the coal was made, and the following results were obtained :—

	Per cent.
Carbon	70·69
Hydrogen	4·65
Oxygen	5·55
Nitrogen	1·24
Sulphur	4·70
Ash	8·64
Water	4·53
	100·00

The calorific power of the coal was also determined by Thompson's calorimeter, and the following results were obtained :—

Pounds of water evaporated from 212 degs. Fahr. by 1 lb. of the coal .. .. 13·4 lb.

Analysts—J. and H. S. Pattinson.

Date of Analysis—August 30, 1904.

Notes.

YORKSHIRE.

Colliery—GLASS HOUGHTON, Castle Seam, No. 2 Pit.

Glass Houghton "Castle" Coal.

Class of Coal—Gas.

The coal was submitted to distillation in a coal-testing apparatus at a temperature of 1,000 degs. Cent., and the gas yielded was measured. This gas was burnt in a photometer, fitted with the No. 1 London Argand standard burner, at such a rate as to give the maximum efficiency of illumination; the illuminating power was determined, and the proportionate illuminating power at the standard rate of consumption of 5 cubic feet per hour was calculated from the results.

Yield of gas per ton of coal in cubic feet ..	11,500
Illuminating power of the gas in standard sperm candles	16·5
Illuminating value of gas expressed in pounds of sperm per ton of coal ..	651

The coals yielded the following percentage amounts of coke and volatile matters :—

	Per cent.
Non-volatile matters—coke	63·8
Volatile matters, including water expelled at 1000 degs. Cent. in a closed vessel	36·2
	100·0

A complete "ultimate" analysis was made of the coal, and the following result was obtained :—

	Per cent.
Carbon	79·09
Hydrogen	5·09
Oxygen	6·44
Nitrogen	1·37
Sulphur	0·98
Ash	3·08
Water	3·95
	100·00

The calorific power of the sample was also determined, and the following results were obtained :—

Pounds of water evaporated from 212 degs. Fahr. by 1 lb. of the coal	14·6

These are coals of high sperm value and good calorific power. They yield a good, dense, hard, clean coke. They are excellent coals for gas-making purposes.

Analysts—J. and H. S. Pattinson.

Date of Analysis—April 5, 1906.

YORKSHIRE.

Notes.

Mr. JOSEPH HAIGH,

Bruntcliffe, near Leeds.

Colliery—VICTORIA, Beeston Seam, Bruntcliffe Pit.
Shipping Ports—Hull, Goole.
Rail—Great Northern, Morley Station.
Canal—None.

Bruntcliffe Beeston Gas Coal.

Class of Coal—Gas.

Specific gravity of the coal	1·267
Purified gas per ton	11,800 cubic feet
Illuminating power	21·34 std. candles
Value of 1 cubic foot	512·16 grains sperm
Illuminating matter per ton	863·35 lb. sperm
Coke per ton	1,375 lb.
Coke	61·38 per cent.
Ash in coke..	8·05 per cent.
Fixed carbon in coke	91·95 per cent.
Sulphur in coal	0·89 per cent.
Tar per ton of coal	10 gallons
Ammoniacal liquor per ton of coal	19 gallons

Analysts—Thomas Newbigging and Son.
Date of Analysis—April 17, 1896.

Colliery—VICTORIA, Black Bed Seam, Bruntcliffe Pit.

Bruntcliffe Black Bed Gas Coal.

Class of Coal—Gas.

Specific gravity of the coal	1·314
Purified gas per ton	11,350 cubic feet
Illuminating power	18·36 std. candles
Illuminating matter per ton	714·46 lb sperm
Coke per ton	1,409 lb.
Coke	62·90 per cent.
Ash in coke..	3·48 per cent.
Fixed carbon in coke	96·52 per cent.
Sulphur in coal	1·46 per cent.
Tar per ton of coal..	9·46 gallons
Ammoniacal liquor per ton of coal	19·25 gallons

Analysts—Thomas Newbigging and Son.
Date of Analysis—June 22, 1895.

Notes.

YORKSHIRE.

HOWLEY PARK COAL AND CANNEL COMPANY,

Batley.

Colliery—HOWLEY PARK, Cannel, Beeston, and Middleton Coal Seams, Howley Park Pit.

Shipping Ports—Goole and Hull.

Rail—L. and N. W., Batley Station.

Canal—Manchester Ship Canal.

Cannel Coal.

Class of Coal—Gas.

The coal contains :—	Per cent.	Lb. per ton.
Moisture (given off at 212 degs. Fahr.)	1·46	32·704
Volatile matter (at red heat)	43·04	964·096
Fixed matter (coke and ash)	55·50	1243·200
	100·00	2240·000
Containing ash	7·90	176·960
Total sulphur in coal	2·01	45·024

Analysed in a model gas apparatus, one hundredth ton or 22·4 lb. of coal give :—

	Per cent.	Lb. per ton.
Tar	11·44	256·24
Ammoniacal liquor, 3·4 degs. Twaddell, 6·8 oz. strength	5·86	131·25
Containing real ammonia	1·47	32·93
Coke	57·05	1278·12
Cubic feet of gas per ton (bar 30 in., temperature 60 degs. Fahr.)		12,101 cubic ft.
Illuminating power of gas in standard candles per 5 cubic feet of gas per hour		27·4
Giving value of gas in pounds of sperm		1136·8
Sulphur in gas after passing through lime purifiers in grains per 100 cubic feet		17·71 cubic ft

Analyst—Thomas Fairley, F.R.S.E.

Date of Analysis—January 25, 1899.

Beeston Coal.

Class of Coal—Gas.

The sample contains :—	Per cent.	Lb. per ton.
Moisture (given off at 212 degs. Fahr.)	1·73	38·752
Volatile matter at red heat)	35·80	801·920
Fixed matter (coke and ash)	62·47	1399·328
	100·00	2240·000

Notes.

YORKSHIRE.

	Per cent.		Lb. per ton.
Containing ash	3·19	..	71·456
Total sulphur in coal	1·46	..	32·700

Analysed in a model gas apparatus, one-hundredth ton or 22·4 lb. of coal give :—

	Per cent.		Lb. per ton.
Tar	6·69	..	150·000
Ammoniacal liquor (1·0 deg. Twaddell, 2·0 oz. strength)	6·70	..	150·160
The ammoniacal liquor contains :—			
Real ammonia	0·43	..	9·63
Cubic feet of gas per ton (bar. 30 in., temperature 60 degs. Fahr.)			11,236 cubic ft.
Illuminating power of gas in standard candles per 5 cubic feet of gas in 24-hole burner			18·0
Giving value in pounds of sperm			693·4 lb.

Analyst—Thomas Fairley.

Date of Analysis—June 10, 1907.

Middleton Little Coal.

Class of Coal—Gas.

The coal contains :—	Per cent.		Lb. per ton.
Moisture (given off at 212 degs. Fahr.)	2·28	..	51·072
Volatile matter (at red heat)	36·90	..	826·560
Fixed matter (coke and ash)	60·82	..	1362·368
	100·00		2240·000
Containing ash	3·36	..	75·264
Total sulphur in coal	1·65	..	36·960

Analysed in a model gas apparatus, one-hundredth ton or 22·4 lb. of coal give :—

	Per cent.		Lb. per ton.
Tar	2·51	..	56·250
Ammoniacal liquor, 1·8 degs. Twaddell, 3·6 oz. strength	6·41	..	143·750
Containing real ammonia	0·78	..	17·470
Cubic feet of gas per ton (bar 30 in., temp. 60 degs. Fahr.)	11,272·5 cubic feet		
Illuminating power of gas in standard candles per 5 cubic feet of gas in Argand burner	17·3 std. candles		
Giving value in pounds of sperm ..	668·6		
Heating power of gas in British thermal units per cubic foot ..	7c8·8		

Analyst—Thomas Fairley.

Date of Analysis—May 10, 1904.

Notes.

YORKSHIRE.

HOYLAND SILKSTONE COAL AND COKE COMPANY LIMITED,

Hoyland, near Barnsley.

Colliery—HOYLAND SILKSTONE, ... Seam, ... Pit.

Shipping Ports—Keadby, Goole, Hull, Grimsby, Partington, Liverpool.

Rail— { Midland, Elsecar and Hoyland Stations. Great Central, Birdwell Station.

Canal—South Yorkshire (Elsecar Branch).

Hoyland Silkstone Gas Coal.

Class of Coal—Gas.

Specific gravity	1·287	
Purified gas per ton	11,950	cubic feet
Illuminating power	17·72	std. candles
Illuminating matter in sperm per ton	726·01	lb.
Coke per ton	1,500	lb.
Coke	66·96	per cent.
Fixed carbon in coke	94	per cent.
Ash in coke	6	per cent.
Sulphur in coal	1·068	per cent.

Analyst—Thomas Newbigging.

Date of Analysis—April 21, 1892.

Hoyland Silkstone Gas Coal.

Class of Coal—Gas.

Specific gravity of coal (water as 1)	1·27	
Weight of 1 cubic foot	79·375	lb.
Sulphur in coal	0·79	per cent.
Purified gas per ton of coal	11,525	cubic feet
Gas per cubic foot of coal	407·5	cubic feet
Illuminating power of gas consumed in London standard Argand	18·79	sperm candles
Value of 1 cubic foot	450·96	grains sperm
Weight of illuminating matter	742·47	lb. sperm
Weight of coke per ton of coal	1,477	lb.
Percentage of coke in coal	65·937	per cent.
Fixed carbon in coke	95·75	per cent.
Ash in coke	4·25	per cent.
Weight of sulphur per ton of coal	19·936	lb.

Calorific value of coal equal to the evaporation of 14·63 lb. water from 212 degs. by the combustion of 1 lb. of coal.

Analyst—James Paterson.

Date of Analysis—April 11, 1893.

Notes.

YORKSHIRE.

Silkstone Gas Nuts.

Class of Coal—Gas.

Specific gravity	1·256
Purified gas per ton	11,550 cubic feet
Illuminating power	18·09 std. candles
Illuminating matter per ton	716·36 lb. sperm
Coke per ton	1,484 lb.
Coke	66·25 per cent.
Fixed carbon in coke	95·50 per cent.
Ash in coke	4·50 per cent.
Sulphur in coal	0·521 per cent.

Analyst—Thomas Newbigging.

Date of Analysis—April 21, 1892.

New Silkstone Gas Coal.

Class of Coal—Gas.

Specific gravity	1·270
Purified gas per ton	11,850 cubic feet
Illuminating power	18·36 std. candles
Illuminating matter per ton	745·94 lb. sperm
Coke per ton	1,453 lb.
Coke	64·86 per cent.
Fixed carbon in coke	95·45 per cent.
Ash in coke	4·55 per cent.
Sulphur in coal	1·1 per cent.

Analyst—Thomas Newbigging.

Date of Analysis—April 21, 1892.

Notes.

YORKSHIRE.

EXECUTORS OF E. LISTER KAYE,

Denby Grange Collieries, near Wakefield.

Collieries—DENBY GRANGE, ... Seam, ... Pit.

Shipping Port— . . . .

Rail— . . . . Station.

Canal— . . . .

Flockton "New Hards" Gas Coal.

Class of Coal—Gas.

	Per cent.	Lb. per ton.
Moisture (given off at 212 degs. Fahr.)	0·64	14·336
Volatile matter (at red heat)	36·14	809·536
Fixed matter (coke and ash)	63·22	1,416·128
	100·00	2,240·000
Containing ash	1·57	35·168
Total sulphur in coal	0·59	13·216

Analysed in a model gas apparatus, $\frac{1}{100}$ ton, or 22·4 lb. of coal, give:—

	Per cent.	Lb. per ton.
Tar	6·83	153·12
Ammoniacal liquor, 1·92 Twaddell, 3·84 oz. strength	3·76	84·37
Containing real ammonia	0·83	18·59
Coke	63·99	1,437·50
Cubic feet of gas per ton (bar. 30 in., temperature 60 degs. Fahr.)		11,746·6 cubic feet
Illuminating power per 5 cubic feet of gas		19·4 std. candles
Giving value of gas in sperm		781·3 lb.
Sulphur in gas after passing through lime purifiers, in grains per 100 cubic feet		15·54 grains

Analyst—Thomas Fairley.

Date of Analysis—June 25, 1894.

WORKING ANALYSIS.

Average of tests made from bulk in the usual manner of working. The coal is of first class quality for the purposes of gas manufacture, and shows a large yield of gas per ton (of high illuminating power), also of residual products. The coke produced therefrom is of excellent quality and suitable for all commercial and gasworks firing purposes.

Notes.

YORKSHIRE.

Commercial analysis (average of tests)—

Specific gravity of coal (water as 1) ..	1·268
Weight of 1 cubic foot	79·25 lb.
Purified gas per ton of coal	11,034 cubic feet
Purified gas per cubic foot of coal	390·37 cubic feet
Illuminating power ascertained by a certified Letheby-Bunsen photometer, bearing the Board of Trade stamp, 1898, Methven screen, and standard pentane tests	18·44 candles
Value of gas from 1 ton of coal, in sperm	697·6 lb.
Value of gas in sperm per cubic foot of gas	442·56 grains
Weight of coke per ton of coal	1,491 lb.
Percentage of coke in coal	66·56 per cent.
Tar per ton of coal, obtained to outlet of condensers	11·6 gallons
Ammoniacal liquor, obtained to outlet of condensers	22·7 gallons
Strength of ammoniacal liquor	$4\frac{3}{8}$ degs. Twaddell
Strength of ammoniacal liquor (oz. strength)	$8\frac{3}{4}$ oz.

Analyst—Matt. Dunn, M.I.Mech.E.

Date of Analysis—August 24, 1901.

Wheatley Gas Coal.

Class of Coal—Gas.

Purified gas, per ton	10,600 cubic feet
Illuminating power	17·72 candles
Coke (hot)	10 cwt. 2 qrs. 24 lb.
Tar	15 gallons
Liquor (5 degs. Twaddell)	26 gallons
Quality of coke	Large, good and clean

Analyst—S. Meunier.

Date of Analysis—February 22, 1901.

Notes.

YORKSHIRE.

LOFTHOUSE COLLIERY COMPANY,

Lofthouse Colliery, near Wakefield.

Colliery—LOFTHOUSE, Silkstone Seam, Lofthouse Pit.
Shipping Ports—Goole, Hull.
Rail—Great Northern, Lofthouse Station.
Canal—Aire and Calder Navigation.

Silkstone Gas Coal.

Class of Coal—Gas.

The coal contains—	Per cent.	Lb. per ton.
Moisture (given off at 212 degs. Fahr.) ..	1·88 ..	42·112
Volatile matter (at red heat)	33·45 ..	749·280
Fixed matter (coke and ash)	64·67 ..	1,448·608
	100·00 ..	2,240·000
Containing ash	7·75 ..	173·600
Total sulphur in coal	3·50 ..	78·400

Analysed in a model gas apparatus, one-hundredth ton, or 22·4 lb. of coal, give :—

	Per cent.	Lb. per ton.
Tar	10·71 ..	262·500
Ammoniacal liquor 2·5 degs. Twaddell, 5 oz. strength	9·71 ..	218·750
Containing real ammonia	1·08 ..	24·192
Cubic feet of gas per ton (bar. 30 in., temperature 60 degs. Fahr.)	10,950 cubic feet	
Illuminating power of gas in standard candles per 5 cubic feet of gas in 24-hole burner..	18·4 candles	
Giving value in sperm	690·7 lb.	
Coke .. .. per cent.	63·88 ..	1,431·250 lb.
Containing combustible matter	83·40	In 100 parts of coke
Containing ash	14·75	In 100 parts of coke
Containing (total sulphur 2·89 per cent.)		In 100 parts of coke

Analyst—Thomas Fairley.

Date of Analysis—March 21, 1903.

Notes.

YORKSHIRE.

Colliery—LOFTHOUSE, Silkstone Little Coal Seam, Lofthouse Pit.

Little Coal.

Class of Coal—Steam.

The coal contains—	Per cent.	Lb. per ton.
Moisture (given off at 212 degs. Fahr.)	2·60	58·240
Volatile matter (at red heat)	33·68	754·432
Fixed matter (coke and ash)	63·72	1,427·328
	100·00	2,240·000
Containing ash	4·60	103·040
Total sulphur in coal	1·33	29·792

Analysed in a model gas apparatus, one-hundredth ton, or 22·4 lb. of coal, give :—

	Per cent.	Lb. per ton.
Tar	7·53	168·750
Ammoniacal liquor (2 degs. Twaddell, 4 oz. strength)	6·41	143·750
Containing real ammonia	0·86	19·264
Cubic feet of gas per ton (bar. 30 in., temp. 60 degs. Fahr.)	11,000 cubic feet	
Illuminating power of gas in standard candles per 5 cubic feet of gas in 24-hole burner	18·4 candles.	
Giving value in sperm	—	693·9 lb.
Coke	64·45	1,443·750 lb.
Containing combustible matter	87·70	In 100 parts of coke.
Containing ash	8·90	
Containing (total sulphur, 0·76 per cent.)		

Analyst—Thomas Fairley.
Date of Analysis—March 23, 1903.

LOW MOOR COAL COMPANY LIMITED,

Low Moor, Bradford.

Colliery—LOW MOOR, Better Bed Seam, ... Pit.
Shipping Port—None.
Rail—Lancashire and Yorkshire, Low Moor Station.
Canal—Calder and Hebble.

Better Bed Coal.

Class of Coal—Manufacturing,

	Per cent.
Ash	7·00
Sulphur	0·51
Volatile matter	30·43
Moisture	2·11
Fixed carbon (by difference)	59·95

Analyst—Wm. McD. Mackey.
Date of Analysis—June 19, 1902.

Notes.

YORKSHIRE.

Colliery—LOW MOOR, Black Bed Seam, ... Pit.

Black Bed Coal.

Class of Coal—Gas, Steam.

	Per cent.
Ash	1·44
Sulphur	1·20
Volatile matter (includes water 1·92 per cent.)	34·28
Fixed carbon (by difference) ..	63·08
	100·00

Pounds of water evaporated from 212 degs. F. by 1 lb. of the coal (determined in Lewis Thomson's calorimeter)	14·79 lb.
Equal to a calorific value of coal in Centigrade heat units (being pounds of water capable of being heated 0 to 1 deg. Cent. by 1 lb. of coal)	7,942

The following analysis of the same coal (Black Bed) proves its adaptability for gasmaking purposes:—

Specific gravity	1·277	
Weight of 1 cubic foot	79·68	
Purified gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	11,483	cubic feet
Illuminating power of gas (by No. 1 London Argand 24-hole burner)	17·0	std. candles
Value of gas, per ton of coal, in sperm ..	669·3	lb.
Yield of coke per ton of coal	12·99	cwt.
Equal to a percentage yield of coke of ..	64·96	per cent.
Ammoniacal liquor per ton of coal	3·41	lb.
Equal to a yield of sulphate of ammonia per ton of coal	13·27	lb.
Ash in coke..	2·21	per cent.

The resulting coke was of good quality.

Analyst—Wm. McD. Mackey.

Date of Analysis—June 19, 1902.

Notes.

YORKSHIRE.

THE MICKLEFIELD COAL AND LIME COMPANY LIMITED,

East Parade, Leeds.

Colliery—PECKFIELD, Beeston Thick Seam, ... Pit.
Shipping Ports—Hull, Goole, Heysham Barrow-in-Furness.
Rail—North Eastern, Micklefield Station.
Canal— . . . .

Micklefield Steam Coal.

Class of Coal—Steam.

	Per cent.
Carbon	78·92
Hydrogen	5·07
Oxygen	9·84
Nitrogen	0·75
Sulphur	1·28
Ash	4·14
	100·00
Water lost by drying at 100 degs. Cent.	7·17

Calorific power determined in Thompson's calorimeter.
Pounds of water evaporated from 100 degs. Cent. by 1 lb. of the coal .. .. .. 14·1 lb.
Equal to 7·558 degs Cent. heat units.

Micklefield Gas Coal.

Class of Coal—Gas.

10,500 cubic feet of gas of 17·58 candles.
Weight of illuminating matter, in sperm per ton, 627·9 lb.
Commercial analysis (average of tests)—

Specific gravity of coal (water as 1) ..	1·260	
Weight of 1 cubic foot	78·43	lb.
Sulphur in coal	0·42	per cent.
Sulphur in coal per ton	9·35	lb.
Purified gas per ton of coal	10·444	cubic feet
Purified gas per cubic foot of coal ..	366·61	cubic feet
Illuminating power ascertained by a certified Letheby-Bunsen photometer, bearing Board of Trade Stamp, 1895 ..	17·40	candles
Value of gas from 1 ton of coal in sperm ..	623·01	lb.
Value of 1 cubic foot of gas in sperm ..	417·32	grains
Weight of coke per ton of coal	1,484	lb.

Notes.

YORKSHIRE.

Micklefield Gas Coal—*cont.*

Percentage of coke in coal	66·37	per cent.
Fixed carbon in coke	95·75	per cent.
Ash in coke	4·25	per cent.
Tar per ton of coal	10·90	gallons
Weight of tar per ton of coal	125·5	lb.
Ammoniacal liquor per ton of coal ..	17·65	gallons
Strength of ammoniacal liquor	2·75	degs. Twadd.

Analyst—Matt. Dunn, A.M.I.Mech.E.

Date of Analysis—April 3, 1897.

MIRFIELD COAL COMPANY,

Ravensthorpe, Dewsbury.

Colliery—MIRFIELD, Black Bed Seam, Dark Lane, Calder, and Mirfield Moor Pits.

Shipping Ports—Goole, Hull, Liverpool, Manchester Ship Canal.

Rail—Lancashire and Yorkshire, L. and N. W., Northope, Mirfield, and Ravensthorpe Stations.

Canal—Calder and Hebble.

Mirfield Gas Coal.

Class of Coal—Gas.

Colour: bright black and shining; horizontal partings: rough and shining, with occasional slight deposits of shale; vertical partings: smooth, with very slight deposits of carbonate of lime; fracture: irregular; cross fracture: irregular, showing slight deposits of iron pyrites. It also contains a band of rich cannel, from 2½ to 3 inches thick, constituting about 10 per cent. of the whole. The cannel has a pitchy appearance and fractures conchoidally. Soft and rather friable. On the fire it intumesces and agglomerates slightly. Colour of ash: dark grey; specific gravity: 1·326 (water=1); weight of 1 cubic foot 82·78 lb.

Chemical analysis—	Per cent.
Volatile matter (containing 1·92 per cent. of sulphur)	29·53
Fixed combustible matter ..	66·32
Ash	3·55
Water expelled at 112 degs. Fahr.	0·60
	100·00

YORKSHIRE.

Notes.

Practical analysis—

Purified gas per ton (bar 30 in., ther. 60 degs.)	11.584 cubic feet
Illuminating power of gas (std. burner) ..	18·76 sperm candles
Value of illuminating matter per ton in sperm	745·10 lb.
Hydrocarbons in gas	4·25 per cent.
Carbon oxide in gas	8·25 per cent.
Carbonic acid (foul gas	2·00 per cent.
Sulphuretted hydrogen (foul gas)	2·00 per cent.
Tar produced per ton	91·66 lb.
Liquor produced per ton	143·75 lb.
Strength of ammoniacal liquor	5 degs. Twaddell
Quantity of coke produced	1,565·25 lb.
Ash in coke	5·03 per cent.

The above results are the mean of four tests at Halifax Corporation Gasworks, and show the coal to be of first-class quality for gas and heating purposes.

Analyst—Wm. Carr.

Date of Analysis—March 13, 1879.

Another analysis gave the following results:—The coal is clean and very free from foreign matters. Surfaces bright and shining, rather friable, and cubical in all directions. Streak: brownish black. On the fire it fuses and intumesces, leaving a light brown coloured ash. Its specific gravity is 1·252 (water as 1). The weight of 1 cubic foot is therefore 78·026 lb. One cwt. of lime purifies about 17,000 cubic feet of gas. It appears from the results to stand at the head of our gas coals.

Commercial analysis—

Purified gas per ton of coal	12,600 cub. feet. (average)
Matters condensable by bromine	5·15 per cent.
Illuminating power of gas consumed in a London standard Argand, at the rate of 5 cubic feet per hour, in sperm candles of 120 grains each	16·67 candles
Value of 1 cubic foot in sperm	400·00 grains
Weight of illuminating matter per ton of coal in sperm	720·00 lb.
Weight of coke per ton of coal	143·00 lb.
Ash in coke	1·88 per cent.

Analyst—James Paterson.
Date of Analysis—May 3, 1877.

Notes.

YORKSHIRE.

Mirfield Gas Coal—*cont.*

Analysis—

Specific gravity	1·275
Purified gas per ton	12,300 cubic feet
Illuminating power of gas	20·84 standard sperm [candles
Illuminating matter in sperm per ton ..	878·85 lb.
Coke per ton	1,328 lb.
Coke	59·29 per cent.
Fixed carbon in coke	95 per cent.
Ash in coke	5 per cent.
Sulphur in coal	2·07 per cent.

Analysts—Thomas Newbigging and Son.

Date of Analysis—June 4, 1904

The Manager, Yeovil Corporation Gas Department (Somersetshire) writes (July 18, 1904):—"I am glad to be able to write favourably of your coal for gasmaking purposes. I find that a make of 11,500 cubic feet per ton of 17 to 18 candle gas may be relied upon in regular every day working."

The Manager, Wilmslow and Alderley Edge Gas Company, near Manchester, writes (August 12, 1904):—"I have the pleasure of giving you the practical results of our working from July 31 to August 12, 1904, with Mirfield unscreened gas coal:—

Coal carbonised	268 tons 10 cwt.
Gas made	3,028,000 cubic feet
Average make per ton	11,277 cubic feet
Illuminating power	18·7 candles (average)
Coke (excellent)	13 cwt. 1 qr. 15 lb.
Tar (per ton)	10 gallons
Liquor 4½ Twaddell	9 gallons

The following results are reported from the Bury St. Edmund's Gasworks as obtained from an ordinary working of Mirfield coal:—

Yield of gas per ton	11,060 cubic feet
Illuminating power	18·51 std. candles
Quantity of coke	13 cwt. 3 qrs.

In the use of Mirfield coal at the Stratford-on-Avon Gasworks an average working yielded 10,875 cubic feet of 18·23 candle gas, and 14 cwt. 3 qrs. of coke per ton of coal carbonised.

"I have used the Mirfield coal this winter almost exclusively in Petersfield, Emsworth, Cosham and Litchfield Gasworks. I find it a very good coal, yielding a large quantity of gas and an excellent coke;

YORKSHIRE.

Notes.

care must, however, be taken to have good heats and not to charge heavily. In small gasworks, where charging is done by the shovel, the stoker should be careful to have his charges thinly and evenly spread over the floor of the retort."—J. Douglas, late president British Association of Gas Managers.

MITCHELL MAIN COLLIERY COMPANY LIMITED,

25, Regent Street, Barnsley.

Colliery—MITCHELL MAIN (Wombwell), ... Seam, ... Pit.

Shipping Ports—Goole, Grimsby, Hull, Liverpool, Manchester.

Rail—Great Central, Wombwell Station.

Canal—Dearne and Dove.

Mitchell Main Gas Coal.

Class of Coal—Gas.

Purified gas per ton	11,500 cubic feet
Illuminating power	18·10 std. candles
Illuminating matter per ton	713·65 lb. sperm
Coke per ton	1,468 lb.
Volatile matter	29·53 per cent.
Ash (faint red colour)	4·5 per cent.
Fixed combustible matter	64·30 per cent.
Total sulphur	1·53 per cent.
Moisture at 100 degs. Cent.	1·67 per cent.

The sample of coal was very free from visible iron pyrites or sulphate of lime, and is a good one for gasmaking purposes. The coke resulting therefrom is of good quality.

Analyst—Frank Scudder.

Date of Analysis—April 27, 1903.

Notes.

YORKSHIRE.

JOHN NAYLOR AND CO. LIMITED,

Ossett, R.S.O.

Colliery—PILDACRE, Flockton Seam, Flockton Pit.
Shipping Ports—Hull and Goole.
Rail—G.N.R., Ossett Station.
Canal—None.

Flockton Coal (Unscreened).

Class of Coal—Gas.

Specific gravity of coal (water as 1·000) ..	1·278
Weight of 1 cubic foot	79·75 lb.
The yield of purified gas per ton of 2,240 lb., at a temperature of 60 degs. F., the barometer at 30 in.	11,000 cubic feet
The illuminating power of the gas by a London standard Argand burner is equal to standard sperm candles, each consuming 120 grains per hour, the burner consuming 5 cubic feet of gas per hour	16·0 candles
The value of the illuminating matter contained in 1 ton of gas obtained is equal to	600·04 lb. sperm
Coke, red, per ton	13 cwt.
Coke, slacked out, per ton (drained 12 hds)..	16 cwt. 3 qr. 27 lb.
Ammoniacal liquor per ton	17·31 gallons
Specific gravity .. ..on	1·022 4½ degs. Twaddell
Tar per ton	12·10 gallons
Specific gravity .. ..on	1·140 28 degs. Twaddell
Ash in coal	3·2 per cent.
Sulphur in coal	1·4 per cent.

Analyst—Robt. I. Tootill.

Date of Analysis—April 24, 1891.

Flockton Coal (Screened).

Class of Coal—Gas.

Specific gravity of coal (water as 1·000) ..	1·278
Weight of 1 cubic foot	79·6 lb.
Yield of purified gas per ton of 2,240 lb., at a temperature of 60 degs. Fahr., the barometer at 30 in.	12,000 cubic feet

YORKSHIRE.

Notes.

The illuminating power of the gas by a London standard Argand burner is equal to standard sperm candles, each consuming 120 grains per hour, the burner consuming 5 cubic feet of gas per hour	16·5 candles
The value of the illuminating matter contained in 1 ton of gas obtained is equal to	678·54 lb. sperm
Coke, red, per ton	12 cwt. 3 qr. 18 lb.
Coke, slacked out, per ton (drained 12 hds.) ..	16 cwt. 3 qr.
Ammoniacal liquor per ton	18·00 gallons
Specific gravity	on 1·022 4½ degs. Twadd.
Tar per ton	12·11 gallons
Specific gravity	on 1·140 28 degs. Twadd.
Ash in coal	2·25 per cent.
Sulphur in coal	1·2 per cent.

Analyst—Robt. I. Tootill.

Date of Analysis—April 24, 1891.

Pildacre Gas Coal.

Class of Coal—Gas.

	Per cent.	Lb. per ton.
Moisture (given off at 212 degs. Fahr.) ..	0·61 ..	13·664
Volatile matter (at red heat)	43·37 ..	971·488
Fixed matter (coke and ash)	56·02 ..	1,254·848
	100·00 ..	2,240·000
Containing ash	9·67 ..	216·61
Total sulphur in coal	2·07 ..	46·36

Analysed in a model gas apparatus, one-hundredth ton, or 22·4 lb., of coal give :—

Tar	11·71 per cent. ..	262·50 lb. per ton
Ammoniacal liquor (2·2 Twad., 4·4 oz. strength)	5·85 degs. ..	131·25 degs.
Containing real ammonia	0·95 per cent. ..	21·36 lb. per ton
Coke	57·05 per cent. ..	1,278·12 lb. per ton
Yield of gas per ton (bar. 30 in., temperature 60 degs. Fahr.)		11,575·0 cubic feet
Illuminating power of gas per 5 cubic feet of gas		28·5 std. candles
Giving value of gas in sperm		1,131·0 lb.
Sulphur in gas, after passing through lime purifier, per 100 cubic feet		18·38 grains

Analyst—Thomas Fairley.

Date of Analysis—May 8, 1893.

Notes.

YORKSHIRE.

NEW SILKSTONE AND HAIGH MOOR COAL COMPANY LIMITED,

Castleford.

Colliery—ALLERTON BYWATER, ... Seam, Silkstone Pit.

Shipping Ports—Hull, Goole.

Rail—North Eastern, Ledstone Station.

Canal—Aire and Calder.

Special Gas Coal.

Class of Coal—Gas.

	Per cent.	Lb. per ton.
Chemical analysis—		
Moisture (given off at 212 degs. Fahr.) ..	4·85 ..	108·64
Volatile matter (at red heat)	35·07 ..	785·56
Fixed matter (coke and ash)	60·08 ..	1,345·79
Ash in coke	3·13 ..	70·11
Total sulphur in coal	1·27 ..	28·45
Practical results—		
Yield of gas per ton (temperature 60 degs. Fahr., 30 in. bar.)	12,148·6 cubic feet	
Illuminating power of gas per 5 cubic feet of gas in 24-hole burner	19·66 std. candles	
Giving value of sperm	818·80 lb.	
	Per cent.	Lb. per ton.
Coke	60·96 ..	1,365·60
Ash in coke	5·69 ..	127·45
Sulphur	0·90 ..	20·16
Tar	7·11 ..	159·40
Ammoniacal liquor (2·2 degs. Twaddell, 4·4 oz. strength), containing real ammonia	Degs. 7·53 ..	Degs. 168·70

Analyst—Thomas Fairley, F.R.S.E.

Date of Analysis—August 5, 1897.

Best Silkstone Gas Coal.

Class of Coal—Gas.

The coal is black, possesses an exceptionally high lustre, with brown streak; fracture highly resinoid, with some slight deposits of charcoal; cross-fracture angular and resinoid, but in part laminated and semi-scalariform; the whole contains slight deposits of calcium carbonate and ferric bisulphide in the natural partings; moderately

YORKSHIRE.

Notes.

cohesive and compact; on the fire it intumesces and agglomerates; colour of ash, dark brown; mean specific gravity, 1·238 (water 1·000); weight of 1 cubic foot, 77·37 lb.

	Per cent.
Chemical analysis—	
Volatile matters (containing 0·56 of sulphur)	35·37
Coke, consisting of—carbon 56·50, sulphur 0·23, ash 2·80	59·53
Water expelled at 212 degs. Fahr.	5·10
	100·00

Practical results (gaseous products)—	
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar.	11,785 cubic feet
Gas from 1 cubic foot of the coal	407·05 cubic feet
Specific gravity of the gas	·486 (air 1·000)
Hydrocarbons absorbed by bromine ..	6·20 per cent.
Durability of 1 cubic foot by 5 in. jet flame	43 min. 8 sec.
Value of 1 cubic foot of gas in sperm ..	483·60 grains
Value of gas from 1 ton of coal in sperm ..	814·17 lb.
Illuminating power of gas in standard candles (per London Argand)	20·15 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·50 per cent.
Carbonic acid (CO_2) in foul gas	2·75 per cent.
Carbonic oxide (CO) in foul gas	6·00 per cent.
Sulphur eliminated with volatile products	15·01 lb.
Liquid products—	
Tar per ton of coal	15·70 gallons
Ammoniacal liquor, per ton of coal ..	19·80 gallons
Strength of ammoniacal liquor	2·50 degs. Twadd.
Hygrometric water per ton of coal ..	11·42 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	7·20 per cent.
Solid products—	
Coke per ton of coal	1,333·47 lb.
Carbon in the coke	95·30 per cent.
Ash in the coke	4·70 per cent.
Sulphur in coke per ton of coal	5·15 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	13·09 lb.

This is a remarkably good coal of its class, for the production of gas and coke. Of the former it yields a large volume of 20·15 candle value, and of the latter about 12 cwt., of the finest quality.

Analyst—Geo. R. Hislop, F.C.S., &c.

Date of Analysis—May 10, 1895.

Notes.

YORKSHIRE.

Colliery—ALLERTON BYWATER, ... Seam, Flockton Pit.

Best Flockton Gas Coal.

Class of Coal—Gas.

The coal is black, possesses considerable lustre and brown streak; fracture irregular and partly defined by deposits of charcoal, but chiefly resinoid; cross-fracture angular and resinoid with natural vertical partings, dividing into plates and containing deposits of calcium carbonate and ferric bisulphide; moderately cohesive and compact; on the fire it intumesces and agglomerates; colour of ash, brown; mean specific gravity, 1·208 (water 1·000); weight of 1 cubic foot, 75·5 lb.

		Per cent.
Chemical analysis—		
Volatile matters (containing 0·46 of sulphur)		35·56
Coke, consisting of—		
Carbon	57·11	
Sulphur	0·16	
Ash	1·72	
		58·99
Water expelled at 212 degs. Fahr... ..		5·45
		100·00

Practical results (gaseous products)—	
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar.	11,625 cubic feet
Gas from 1 cubic foot of the coal	391·82 cubic feet
Specific gravity of the gas	·502 (air 1·000)
Hydrocarbons absorbed by bromine ..	6·25 per cent.
Durability of 1 cubic foot by 5in. jet flame	43 mins. 28 secs.
Value of 1 cubic foot of gas in sperm ..	494·40 grains
Value of gas from 1 ton of coal in sperm..	821·06 lb.
Illuminating power of gas in standard candles (per London Argand)	20·60 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·30 per cent.
Carbonic acid (CO_2) in foul gas	2·70 per cent.
Carbonic oxide (CO) in foul gas	9·00 per cent.
Sulphur eliminated with volatile products	10·30 lb.
Liquid products—	
Tar per ton of coal	16·10 gallons
Ammoniacal liquor per ton of coal ..	20·20 gallons
Strength of ammoniacal liquor	2·40 degs. Twad.
Hygrometric water per ton of coal.. ..	11·76 gallons
Aqueous absorbent capacity of coal (determined by complete saturation).. ..	7·80 per cent.

Notes.

YORKSHIRE.

Solid products—

Coke per ton of coal	1,321·37	lb.
Carbon in the coke (very pure)	97·10	per cent.
Ash in the coke	2·90	per cent.
Sulphur in coke per ton of coal	3·58	lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	13·34	lb.

This is one of the best bituminous coals for the production of gas and coke that I have examined; in addition to a large volume of 20·6 candle gas, it affords 11·8 cwt. per ton of remarkably pure coke.

Analyst—Geo. R. Hislop, F.C.S., &c.

Date of Analysis—May 11, 1895.

Steam Coal.

Class of Coal—Steam.

	Per cent.
Ash	3·12
Sulphur	1·38
Volatile hydrocarbons	36·77
Water	5·67
Fixed carbon, by difference ..	53·06
	100·00

Water evaporated from 212 degs. Fahr. by combustion of 1 lb. of the coal (by Thomson's calorimeter)	13·54 lb.
Equals	7,270 calories

The ash is low and the evaporation power good. I consider it a valuable steam coal.

Analyst—Wm. McD. Mackey, F.I.C.

Date of Analysis—May 19, 1896.

Notes.

YORKSHIRE.

NEWTON, CHAMBERS AND CO. LIMITED,

Thorncliffe, near Sheffield.

Colliery— . . . . Seam, ... Pit.
Rail— . . . . . . Station.
Canal— . . . . . .

Thorncliffe Gas Coal.

Class of Coal—Gas.

Yield of gas per ton of coal	12,500 cubic feet
Yield of coke per ton of coal	1,432 lb.
Ash in coke	2·32 per cent.
Specific gravity of coal	1·266
Condensation by bromine	4 per cent.
Illuminating power	14·45 sperm candles
Value of 1 cubic foot in sperm	347 grains
Value of gas per ton of coal	605·33 lb. sperm
Gas purified by 1 cwt. of lime	16,000 lb.

Results obtained by seven days' ordinary working—

Quantity carbonised	672 tons of 20 cwt.
Purified gas per ton at 60 degs. Fahr.	11,110 cubic feet
Coke, of very good quality, per ton of 20 cwt. of coal	14 cwt.
Average illuminating power of gas by the London standard burner	18·06 candles

Analyst— . . . . . .
Date of Analysis— . . . . . .

NUNNERY COLLIERY COMPANY LIMITED,

Corn Exchange Buildings, Sheffield.

Colliery— . . . . . . Seam, ... Pit.
Shipping Port— . . . . . .
Rail— . . . . . . Station.
Canal— . . . . . .

Screened Bright Gas Coal.

Class of Coal—Gas.

Purified gas per ton	11,450 cubic feet
Illuminating power	16·33 std. candles
Illuminating matter in sperm per ton	641·06 lb.
Weight of coke per ton	1,359 lb.

YORKSHIRE.

Notes.

Percentage of coke yielded	60·66 per cent.
Fixed carbon in coke	96·00 per cent.
Ash in coke	4·00 per cent.
Sulphur in coal	0·686 per cent.

Analysts—Thos. Newbigging and Sons.

Date of Analysis—May 1904.

Washed Gas Nuts.

Class of Coal—Gas.

Purified gas per ton	10,800 cubic feet
Illuminating power	17·42 std. candles
Illuminating matter in sperm per ton	645·03 lb.
Weight of coke per ton	1,406 lb.
Percentage of coke yielded	62·76 per cent.
Fixed carbon in coke	92·00 per cent.
Ash in coke..	3·00 per cent.
Sulphur in coal	0·596 per cent.

Analysts—Thomas Newbigging and Sons.

Date of Analysis—May 1904.

Washed Pea Nuts.

Class of Coal—Gas.

Purified gas per ton	11,400 cubic feet
Illuminating power	16·13 std. candles
Illuminating matter in sperm per ton	630·48 lb.
Weight of coke per ton	1,422 lb.
Percentage of coke yielded	63·48 per cent.
Fixed carbon in coke	96·00 per cent.
Ash in coke..	3·00 per cent.
Sulphur in coal	0·640 per cent.

Analysts—Thomas Newbigging and Sons.

Date of Analysis—May 1904.

Notes.

YORKSHIRE.

OLD SILKSTONE COLLIERIES LIMITED,

Dodworth, near Barnsley.

Colliery—OLD SILKSTONE, ... Seam, Dodworth Pit.

Shipping Ports—Keadby, Goole, Hull, Grimsby, Partington, Liverpool, &c.

Rail—Great Central, Dodworth Station.

Canal— . . . . . .

Old Silkstone Gas Coal.

Class of Coal—Gas.

Gas per ton of coal	11,353 cubic feet
Illuminating power	18·99 std. candles
Value of 1 cubic foot of gas in sperm	456 grains
Sperm value per ton of coal	739 lb.
Coke per ton of coal	1,447 lb.
Coke	64·61 per cent.
Tar per ton of coal	14·24 gallons
Ammoniacal liquor	26·60 gallons

Analyst—R. O. Paterson.

Date of Analysis—June 5, 1903.

Old Silkstone Cannel.

Class of Coal—Gas.

Practical results—	
Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	13,000 cubic feet
Illuminating power of gas in standard sperm candles	23·5 candles
Coke	63 per cent.
Coke per ton of coal	1,411 lb.
Colour of ash	Light red grey

The above is a good cannel, and compares well with the Lancashire cannels for gasmaking purposes. It produces an excellent coke.

Analyst—W. J. Orsman.

Date of Analysis—October 10, 1901.

Notes.

YORKSHIRE.

Colliery—STANHOPE SILKSTONE, ... Seam, Stanhope Silkstone Pit.

Shipping Ports—Keadby, Hull, Goole, Grimsby, Partington, Liverpool, etc.

Rail—Lancs. and Yorks, Darton Station.

Canal— . . . . . .

Stanhope Silkstone Gas Coal.

Class of Coal—Gas.

	Per cent.
Water expelled at 212 degs. Fahr.	0·7
Volatile hydrocarbons	33·4
Fixed carbon	63·4
Ash	1·6
Sulphur	0·9
	100·0

Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	12,500 cubic feet
Candle-power	16·17 candles
Coke per ton	64 per cent.

The above is an excellent coal for gas-making purposes, and also gives off easily a large yield of gas of high illuminating power. The coke is hard and well fused.

Analyst—W. J. Orsman.

Date of Analysis—October 10, 1902.

PRIMROSE MAIN COLLIERY COMPANY LIMITED,

Smithies, Barnsley.

Colliery—PRIMROSE MAIN, Winter Seam, Primrose Main Pit.

Shipping Ports—Hull, Goole, Grimsby, Partington, Garston.

Rail—Great Central, Staincross Station.

Canal—*Nil.*

Primrose Main Coal.

Class of Coal—Gas, Manufacturing, House.

		Per cent.
Volatile matters (containing 1·06 per cent. sulphur)..		33·26
Coke, consisting of—		
Carbon	58·93	
Sulphur	0·27	
Ash	2·40	
		61·60
Water expelled at 212 degs. Fahr. ..		5·14
		100·00

Notes.

YORKSHIRE.

Primrose Main Coal—*cont.*

Gaseous products—

Gas per ton of coal	11,200 cubic feet
Gas from 1 cubic foot of coal	345·9 cubic feet
Illuminating power of the gas in standard candles	18·55 candles
Value of 1 cubic foot of gas in sperm ..	454·8 grains
Value of gas from 1 ton of coal in sperm ..	727·6 lb.
Sulphuretted hydrogen (H_2S) in foul gas	2·0 per cent.
Carbonic acid (CO_2) in foul gas	2·4 per cent.
Carbonic oxide (CO) in foul gas	1·0 per cent.
Sulphur eliminated with volatile products, per ton of coal	23·74 lb.

Liquid products—

Tar per ton of coal	8·7 gallons
Ammoniacal liquor per ton of coal ..	27·5 gallons
Strength of ammoniacal liquor	4 degs. Twaddell
Hygrometric water per ton of coal ..	11·5 gallons

Solid products—

Coke per ton of coal	1,380 lb.
Carbon in the coke	95·66 per cent.
Ash in the coke	3·89 per cent.
Sulphur in the coke per ton of coal ..	9·81 lb.

This coal is formed of bright black and dull black layers, with frequent traces of carbonate of lime. Longitudinal, cross, and vertical fractures are all very regular. It is easily broken into long, thin, deep, spiky-looking pieces. The coke is of an excellent quality, and suitable for all commercial purposes. Specific gravity=1·25 (water=1). One cubic foot weighs 78·12 lb.

Analyst—J. Hepworth.

Date of Analysis—April 17, 1894.

SKINNER AND HOLFORD LIMITED,

Waleswood Collieries, near Sheffield.

Colliery—WALESWOOD, ... Seam, Flockton Pit.

Shipping Ports—Grimsby, Hull, Goole, Partington, Liverpool.

Rail—Great Central, Beighton Station.

Canal— . . . .

Flockton Gas Coal.

Class of Coal—Gas.

A sample of this coal, representing the entire product of the seam, gave on examination the following results:—

YORKSHIRE.

Notes.

The coal is black, possesses considerable lustre and brown streak; fracture intermittent and defined by slight deposits of charcoal. Cross-fracture columnar in natural partings, angular, and resinoid to crystalline, with deposits of calcium carbonate and ferric-bisulphide. Moderately cohesive and compact. Under distillation it intumesces and agglomerates. Colour of ash, pale brown. Thickness of seam, 48 in., and of very uniform density. Mean specific gravity, 1·231 (water 1·000). Weight of 1 cubic foot, 76·94 lb.

		Per cent.
Volatile matters (containing 0·55 of sulphur)		32·89
Coke, consisting of—		
Carbon	58·49	
Sulphur	0·18	
Ash	4·29	
		62·96
Water expelled at 212 degs. Fahr. ..		4·15
		100·00

Gaseous products—

Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	12,185 cubic feet
Gas from 1 cubic foot of the coal	418·97 cubic feet
Specific gravity of the gas	·486 (air 1·000)
Hydrocarbons absorbed by bromine ..	5·00 per cent.
Durability of 1 cubic foot by 5 in. jet flame	44 min. 48 sec.
Value of 1 cubic foot of gas in sperm ..	476·88 grains
Value of gas from 1 ton of coal in sperm ..	830·11 lb.
Illuminating power of gas in standard candles (per London Argand)	19·87 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·50 per cent.
Carbonic acid (CO_2) in foul gas	1·75 per cent.
Carbonic oxide (CO) in foul gas	12·32 lb.

Liquid products—

Tar per ton of coal	15·12 gallons
Ammoniacal liquor per ton of coal	15·60 gallons
Strength of ammoniacal liquor	2·75 degs. Twaddell
Hygrometric water per ton of coal ..	9·29 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	5·80 per cent.

Solid products—

Coke per ton of coal	1,410·30 lb.
Carbon in the coke	93·20 per cent.
Ash in the coke	6·80 per cent.
Sulphur in coke per ton of coal	4·03 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	12·80 lb.

Notes.

YORKSHIRE.

Flockton Gas Coal—*cont.*

Compared with Main Lesmahagow cannel coal represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas and 1,535·5 lb. of sperm value per ton, and having regard also to the value of the secondary products, and the cost of the purification of the gas), this coal is equal to 61·28.

Analyst—Geo. R. Hislop.

Date of Analysis—May 16, 1903.

SOOTHILL WOOD COLLIERY COMPANY LIMITED,

Batley.

Colliery— . . . . Seam, ... Pit.
Shipping Port— . . . .
Rail— . . . . Station.
Canal— . . . .

Screened Low Moor Black Bed Coal.

Class of Coal— . . . .

Specific gravity	1·29
Purified gas per ton	11,300 cubic feet
Illuminating power of gas	19·54 std. candles
Illuminating matter in sperm per ton	757·03 lb.
Coke per ton	1,453 lb.
Coke per cent.	64·86 per cent.
Fixed carbon in coke	96·15 per cent.
Ash in coke	3·85 per cent.
Sulphur in coal	2·56 per cent.
Tar per ton of coal	10·0 gallons
Liquor per ton of coal (5 degs. Twaddell)	18·5 gallons

The coke is of excellent quality.

Analysts—Thos. Newbigging and Son, MM.Inst.C.E.

Date of Analysis—June 20, 1903.

Notes.

YORKSHIRE.

TERRY, GREAVES & CO.,

Old Roundwood Collieries, Wakefield.

Colliery—OLD ROUNDWOOD, ... Seam, Silkstone Pit.

Shipping Ports—Hull, Goole.

Rail—Great Northern, Flushdyke Station.

Canal—*Nil.*

Old Roundwood Silkstone Coal.

Class of Coal—Gas, Manufacturing House.

The following is an analysis made for gasmaking purposes :—

	Per cent.	Lb. per ton.
Moisture (given off at 212 degs. Fahr.) ..	1·30	29·12
Volatile matter (at red heat)	35·94	805·06
Fixed matter (coke and ash)	62·76	1,405·82
	100·00	2,240·00
Containing ash	1·24	27·77
Total sulphur in coal	0·94	21·56

Analysed in a model gas apparatus, one-hundredth ton, or 22·4 lb. of coal, gave—

	Per cent.	Lb. per ton.
Tar	6·00	134·40
Ammoniacal liquor (3·0 Twaddell, 6 oz. strength)	5·30	118·80
Containing real ammonia	1·30	29·12
Coke	64·44	1,443·50
Yield of gas per ton	11,600 cubic feet	
Illuminating power of gas per 5 cubic feet of gas	19·65 std. candles	
Giving value of gas in pounds of sperm ..	781·52	
Sulphur in gas, after passing through lime purifier, per 100 cubic feet	21·56 grains	

Analyst—Thomas Fairley.

Date of Analysis—April 10, 1889.

Another analysis gave—

	Per cent.
Carbon in coal	79·90
Ash	2·58
Sulphur	1·95
Oxygen	8·27
Nitrogen	2·10
Hydrogen	5·20
Specific gravity of coal (water as 1 00)	1·27
Weight of 1 cubic foot	79·37 lb.

Analyst—Robt. I. Tootill.

Date of Analysis—March, 1891.

Notes.

YORKSHIRE.

Colliery—OLD ROUNDWOOD, ... Seam, Cannel Pit.

Old Roundwood Cannel Coal.

Class of Coal— . . . . . .

	Per cent.	Lb. per ton.
Moisture (given off at 212 degs. Fahr.) ..	0·79 ..	17·69
Volatile matter (at red heat)	42·04 ..	941·70
Fixed matter (coke and ash)	57·17 ..	1,280·61
	100·00	2,240·00
Containing ash	10·85 ..	243·04
Total sulphur in coal	2·32 ..	51·97

Analysed in a model gas apparatus, one hundredth ton, or 22·4 lb. of coal, gave—

	Per cent.	Lb. per ton.
Tar	10·46 ..	234·40
Ammoniacal liquor (3·8 Twaddell, 7·6 oz. strength)	4·32 ..	96·90
Containing real ammonia	1·64 ..	39·36
Coke	58·73 ..	1,315·60
Yield of gas per ton	12,100 cubic feet	
Illuminating power of gas per 5 cubic feet of gas	28·04 std. candles	
Giving value of gas in sperm	1,164·60 lb.	
Sulphur in gas after passing through lime purifier, per 100 cubic feet	14·42 grains	

Analyst—Thomas Fairley.

Date of Analysis—April 10, 1889.

Cannel Jonnies or Hub.

Class of Coal—Gas.

Analysis made for gasmaking purposes—	Per cent.	Lb. per ton.
Moisture (given off at 212 degs. Fahr.) ..	0·97 ..	21·728
Volatile matter (at red heat)	35·05 ..	785·120
Fixed matter (coke and ash)	63·98 ..	1,433·152
	100·00	2,240·000
Containing ash	44·05 ..	986·72
Total sulphur in coal	1·71 ..	38·30

Analysed in a model gas apparatus, one-hundredth ton, or 22·4 lb. of coal, gave—

Notes.

YORKSHIRE.

	Per cent.	Lb. per ton.
Tar	8·92	200·00
Ammoniacal liquor (3·1 Twaddell, 6·2 oz. strength)	3·76	84·37
Containing real ammonia	1·34	30·01
Coke	62·77	1,406·25
Yield of gas per ton (bar. 30 in., temperature 60 degs. Fahr.)	8,950·0 cubic feet	
Illuminating power of gas per 5 cubic feet of gas	28·9 standard candles	
Giving value of gas in sperm	886·81 lb.	
Sulphur in gas, after passing through lime purifier, per 100 cubic feet	14·38 grains	

Analyst—Thomas Fairley.

Date of Analysis—March 20, 1893.

Snapethorpe Coal.

Class of Coal—Gas.

Analysis made for gas making purposes—	Per cent.	Lb. per ton.
Moisture (given off at 212 degs. Fahr.)	1·25	28·00
Volatile matter (at red heat)	36·70	822·08
Fixed matter (coke and ash)	62·05	1,389·92
	100·00	2,240·00
Containing ash	13·70	306·88
Total sulphur in coal	2·67	59·81

Analysed in a model gas apparatus, one hundredth ton, or 22·4 lb. of coal, gave—

	Per cent.	Lb. per ton.
Tar	9·20	206·25
Ammoniacal liquor (2·6 Twadd., 5·2 oz. strength)	5·58	125·00
Containing real ammonia	1·12	25·088
Coke	65·70	1,471·87
Yield of gas per ton (bar. 30 in., temperature 60 degs. Fahr.)	10,187·8 cubic feet	
Illuminating power of gas per 5 cubic feet of gas	20·9 standard candles	
Giving value of gas in sperm	730·02 lb.	
Sulphur in gas, after passing through lime purifier, per 100 cubic feet	13·74 grains	

Analyst—Thomas Fairley.

Date of Analysis—March 20, 1893.

Notes.

YORKSHIRE.

THE TINSLEY PARK COLLIERY COMPANY LIMITED,

Wharf Street, Sheffield.

Colliery—TINSLEY PARK, Parkgate Seam, Parkgate Pit.

Shipping Ports—Hull, Grimsby, Goole, Keadby, Liverpool, Widnes, Partington and Garston.

Rail—Great Central, Broughton Lane Siding; Great Central and Midland, West Tinsley.

Canal—Sheffield and South Yorkshire.

Parkgate Coal.

Class of Coal—Screened Gas Coal.

Average of two tests—

Specific gravity	1,276	
Purified gas per ton	11,050	cubic feet
Illuminating power of gas in standard sperm candles	16·76	candles
Illuminating matter per ton	634·96	lb. sperm
Coke per ton	1,484	lb.
Coke	66·25	per cent.
Fixed carbon in coke	94·5	per cent.
Ash in coke	5·5	per cent.
Sulphur in coal	1·78	per cent.
Calorific value of gas in cubic feet ..	668	B.T.U.'s

Analysts—Thos. Newbigging and Son.

Date of Analysis—April 27, 1904.

Notes.

YORKSHIRE.

VICTORIA COAL AND COKE COMPANY LIMITED,

Southgate House, Wakefield.

Colliery—PARKHILL, Haighmoor Seam, Haighmoor Pit.
Shipping Ports—Goole, Hull.
Rail—Lancashire and Yorkshire, Wakefield Station.
Canal—Aire and Calder Navigation.

Gas Nuts.

Class of Coal—Gas, Steam, Manufacturing, House.

The coal contains—	Per cent.	Lb. per ton.
Moisture (given off at 212 degs. Fahr.) ..	2·69 ..	60·25
Volatile matter (at red heat)	34·70 ..	777·28
Fixed matter (coke and ash)	62·61 ..	1,402·47
	100·00	2,240·00
Containing ash	8·89 ..	199·13
Total sulphur in coal	1·51 ..	33·82

Analysed in a model gas apparatus, one-hundredth ton, or 22·4 lb. of coal, give—

	Per cent.	Lb. per ton.
Tar	8·94 ..	200·31
Ammoniacal liquor (2·4 degs. Twaddell, 4·8 oz. strength)	5·58 ..	125·00
Containing real ammonia	1·04 ..	23·29
Coke	62·77 ..	1,406·25
Yield of gas per ton	10,459 cubic feet	
Illuminating power of gas per 5 cubic feet of gas	18·5 standard candles	
Giving value in sperm	663·39 lb.	
Sulphur in gas after passing through lime purifiers per 100 cubic feet	15·37 grains	

Analyst—Thomas Fairley, F.R.S.E.
Date of Analysis—May 5, 1891.

Notes.

YORKSHIRE.

Colliery—PARKHILL, Silkstone Seam, Silkstone Pit.

Silkstone Gas Coal (Screened and Unscreened).

Class of Coal—Gas, Steam, Manufacturing, House.

Proximate analysis—		
Moisture	1·15	per cent.
Volatile products	32·54	per cent.
Fixed carbon	60·76	per cent.
Sulphur	1·59	per cent.
Ash	3·96	per cent.
Specific gravity	1·301	
Weight of 1 cubic foot of coal	81·30	lb.
Space occupied by 1 ton	27·55	cubic feet
Commercial analysis—		
Gas per ton of coal	11,247	cubic feet
Gas per cubic foot of coal	408	cubic feet
Illuminating power	18·47	std. candles
Value of 1 cubic foot of gas in sperm ..	443	grains
Sperm value per ton of coal	712	lb.
Coke per ton of coal	13·17	cwt.
Coke	65·86	per cent.
Ash in the coke	6·01	per cent.
Sulphur eliminated with the volatile products	16·00	lb.
Sulphur in the coke (per ton)	19·68	lb.
Tar per ton of coal	13·34	gallons
Liquor per ton of coal	29·74	gallons

Analyst—R. O. Paterson.

Date of Analysis—January 27, 1903.

Colliery—PARK HILL, Stanley Main Seam, Stanley Main Pit.

Screened Steam Coal.

Class of Coal—Steam, Manufacturing, House.

The coal contains—	Per cent.
Moisture (given off at 212 degs. F.)	5·19
Volatile matter (at red heat) ..	33·55
Fixed matter (coke and ash) ..	61·26
	100·00
Containing coke	57·88
Containg also ash	3·38
Total sulphur in coal	1·30

YORKSHIRE.

Notes.

Burnt in Thompson's calorimeter the coal gives 14,319 units of heat that is, it will raise 14,319 lb. of water through one degree Fahr., or it would evaporate 14·84 lb. of water at 212 degs. Fahr.

I find that this coal is of good quality for steam-producing and heating purposes. Its heating power has been carefully tested by repeated experiments in the calorimeter, and in this respect it compares favourably with the majority of other coals of the same class which I have tested. It is comparatively free from excess of sulphur, ash, or other injurious constituents.

Analyst—Thomas Fairley, F.R.S.E.

Date of Analysis—November 11, 1891.

WHARNCLIFFE SILKSTONE COLLIERY COMPANY LIMITED.

Tankersley, near Barnsley.

Colliery—WHARNCLIFFE SILKSTONE, ... Seam, ... Pit.

Shipping Ports—Hull, Goole, Grimsby, Liverpool, Partington.

Rail—Great Central, Midland, Berdwell Station.

Canal—None.

Wharncliffe Silkstone Gas Coal.

Class of Coal—Gas, Coking, Steam, Manufacturing, House.

The coal contains—	Per cent.	Lb. per ton.
Moisture (given off at 212 degs. Fahr.)	1·50	33·600
Volatile matter (at red heat)	34·87	781·088
Fixed matter (coke and ash)	63 63	1,425·312
	100·00	2,240·000
Containing ash	2·45	54·880
Total sulphur in coal	1·55	34·720

Analysed in a model gas apparatus, one hundredth ton, or 22·4 lb. of coal, give—

	Per cent.	Lb. per ton.
Tar	8·78	196·87
Ammoniacal liquor (2·40 Twaddell, 4·80 oz. strength)	5·30	118·75
Containing real ammonia	1·04	23·29
Coke	64·73	1,450·00

Notes.

YORKSHIRE.

Wharncliffe Silkstone Gas Coal—*cont.*

Yield of gas per ton (bar. 30 in., temp. 60 degs. Fahr.)	11,513·6 cubic feet
Illuminating power of gas in standard candles, per 5 cubic feet of gas	18·6 candles
Giving value of gas in sperm	734·2 lb.
Sulphur in gas after passing through lime purifiers per 100 cubic feet	18·02 grains

Analyst—Thomas Fairley.

Date of Analysis—February 25, 1895.

WHARNCLIFFE WOODMOOR COLLIERY COMPANY LIMITED,

Carlton, near Barnsley.

Colliery—WHARNCLIFFE WOODMOOR, Kents Thick Seam, ... Pit.

Shipping Ports—Hull, Goole, Grimsby, Birkenhead, Partington, &c.

Rail—Midland, Great Central, Hull and Barnsley, Barnsley Station.

Canal—Aire and Calder.

Wharncliffe Woodmoor Steam Coal.

Class of Coal—Steam.

Specific gravity (water as 1) ..	1·271
Weight of 1 cubic foot	79·4 lb.

Absolute calorific value and evaporating power represented in pounds of water at 212 degs. Fahr. capable of being turned into steam by the thorough combustion of 1 lb. of coal, 15·45 lb.

	Per cent.
Carbon	81·4
Sulphur	0·7
Ash	2·9
Hydrogen	4·1
Oxygen	8·2
Nitrogen	2·7

Analyst—R. J. Toothill, Manchester.

Date of Analysis—1890.

Notes.

YORKSHIRE.

Wharncliffe Woodmoor Gas Coal.

Class of Coal—Gas.

Yield of gas per ton of coal	11,760 cubic feet
Illuminating power	17·44 std. sp. candles
Coke per ton of coal	1,367 lb.
Sulphur	0·96 per cent.
Ash	1·96 per cent.
Ammoniacal liquor per ton of coal ..	19·7 gallons
Tar per ton of coal	12·2 gallons

Analyst—R. O. Paterson, C.E., Cheltenham Gas Works.
Date of Analysis—August 8, 1894.

WOMBWELL MAIN COLLIERY COMPANY LIMITED,

near Barnsley.

Colliery—WOMBWELL MAIN COMPANY LIMITED, Barnsley and Parkgate Seams, Wombwell Main Pit.
Shipping Ports—Hull, Grimsby, Goole.
Rail—Great Central and Midland, Wombwell (Midland Railway) Station.
Canal— . . . .

Wombwell Main Steam Coal.

Class of Coal—Steam.

Coke—	Per cent.
Carbon	66·30
Ash	3·50
Tar	14·90
Gas water	0·60
Carbonic acid	0·20
Sulphuretted hydrogen	0·06
Gas	14·44
	100·00

Ultimate analysis—	Per cent.
Carbon	85·91
Hydrogen	5·55
Nitrogen	1·83
Oxygen	2·39
Sulphur	0·82
Ash	3·50
	100·00

Analyst—Thomas Richardson.
Date of Analysis—1858.

Notes.

YORKSHIRE.

Wombwell Main House and Gas Coal.

Class of Coal—House, Gas.

Coke—	Per cent.
Carbon	64·20
Ash	2·05
Tar	15·95
Gas water	0·60
Carbonic acid	0·30
Sulphuretted hydrogen	0·05
Gas	16·85
	100·00

Ultimate analysis—	Per cent.
Carbon	88·62
Hydrogen	5·77
Nitrogen	0·93
Oxygen	2·12
Sulphur	0·56
Ash	2·00
	100·00

Analyst—Thomas Richardson.
Date of Analysis—1858.

Wombwell Main Gas Coal.

Class of Coal—Gas.

Gas per ton of coal	11,390 cubic feet
Gas per cubic foot of coal	409 cubic feet
Illuminating power of the gas in standard sperm candles	17·58 candles
Value of 1 cubic foot of the gas in sperm ..	422 grains
Sperm value per ton of coal	686 lb.
Coke per ton of coal	1,496 lb.
Coke per cent. of coal	66·78 per cent.
Ash in coke..	5·57 per cent.
Sulphur eliminated with the volatile products	9·4 lb.
Sulphur in coke	18·8 lb.
Tar per ton of coal	11·68 gallons
Liquor	17·28 gallons
Specific gravity	1·285
Weight of 1 cubic foot of the coal	80·3 lb.
Space occupied by 1 ton	27·9 cubic feet

Analyst—R. O. Paterson.
Date of Analysis—1895.

SCOTLAND.

Notes.

ARGYLL.

CAMPBELTOWN COAL COMPANY LIMITED,

Campbeltown.

Colliery—ARGYLL, Main Seam, Wimbledon Pit.

Shipping Port—Campbeltown.

Rail—Campbeltown and Machrihanish Light Railway Company, Campbeltown Station.

Canal—*Nil.*

Argyll Coal.

Class of Coal—Manufacturing.

	Per cent.
Carbon	65·71
Hydrogen	4·02
Oxygen	9·37
Nitrogen	0·96
Sulphur	0·58
Ash	5·00
Moisture	14·36
	100·00

Analyst—Robert R. Tatlock, F.R.S.E., F.C.S.

Date of Analysis—1884.

AYRSHIRE.

CAPRINGTON AND AUCHLOCHAN COLLIERIES,

Kilmarnock.

Colliery—CAPRINGTON, McNaught Seam, No. 42 Pit.

Shipping Ports—Troon, Ayr.

Rail—Glasgow and South-Western, Gatehead (near Kilmarnock) Station.

Canal— . . . .

McNaught Caprington Steam and House Coal.

Class of Coal—Steam, House.

A sample of this coal gave on analysis the following results:—

The coal is black, possesses considerable lustre and slightly brown streak; fracture irregular and intermittent, partly defined by thin deposits of charcoal; cross-fracture angular, partly cubical, resinoid,

Notes.

AYRSHIRE.

McNaught Caprington Steam and House Coal—*cont.*

and crystalline, with considerable deposits of calcium carbonate in the natural partings; moderately cohesive and compact; under heat it intumesces and agglomerates moderately; colour of ash, reddish-brown; thickness of seam, 34 in.; mean specific gravity, 1·299 (water 1·000); weight of 1 cubic foot, 81·10 lb.

Proximate analysis: The coal, when heated to 2,000 degs. Fahr., yields:—

	Per cent.	Lb. per ton.
Volatile matters	36·65	820·960
Fixed carbon	51·56	1,154·944
Ash	4·14	92·736
Sulphur	0·79	17·696
Moisture	6·86	153·664
	100·00	2,240·000
Coke	55·90	1,252·160

Ultimate analysis: constituents of coal—

	Per cent.
Carbon	71·16
Hydrogen	4·93
Nitrogen	0·76
Oxygen	11·36
Sulphur	0·79
Ash	4·14
Hygroscopic water	6·86
	100·00

Calorific (or heat-producing) power of the coal, as determined by Thomson's calorimeter: 1 lb. of the coal by perfect combustion evolves heat sufficient to convert 12·86 lb. of water from 212 degs. Fahr. into steam; 1 lb. will therefore raise 12,422 lb. of water 1 deg. Fahr. in temperature, or equal to 69·01 lb. of water from 32 degs. to 212 degs. Fahr., or equal to 87·71 lb. of water from 60 degs. to 212 degs. Fahr., or equal to 11·11 lb. of water from 60 degs. to 212 degs. Fahr., thence into steam.

This is a very good and useful coal, alike for steam-raising, household use, and general heating purposes, containing as it does about 76 per cent. of heat-producing elements, with a theoretical heating power equivalent to 13·12 lb. of water converted into steam from 212 degs. Fahr. In the furnace or on the fire it burns freely under a moderate draught, and produces a very intense and long-sustained heat. The coal contains about the average amount of sulphur and water and a very moderate percentage of ash.

Analyst—Geo. R. Hislop, F.C.S., &c.

Date of Analysis—December 28, 1901.

Notes.

AYRSHIRE.

Colliery—CAPRINGTON, McNaught Seam, No. 42 Pit.

McNaught Caprington Coal.

Class of Coal—House.

A sample of this coal, representing the entire product of the seam, gave on examination the following results :—

The coal is black, possesses considerable lustre and slightly brown streak; fracture, rather irregular, partly defined by deposits of charcoal and laminated; cross-fracture angular, partly cubical; resinoid, and partly crystalline, with considerable deposits of calcium carbonate; moderately cohesive and compact; under distillation it intumesces and agglomerates; colour of ash, reddish brown; thickness of seam, 34 in.; mean specific gravity, 1·299 (water 1·000); weight of 1 cubic foot, 81·10 lb.

		Per cent.	
Volatile matters (containing 0·59 of sulphur) ..		37·24	
Coke, consisting of—			
Carbon	51·56		
Sulphur	0·20		
Ash	4·14		
		55·90	
Water expelled at 212 degs. Fahr.		6·86	
		100·00	
Gaseous products—			
Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.		10,945	cubic feet
Gas from 1 cubic foot of the coal		396·27	cubic feet
Specific gravity of the gas		·495	(air 1·000)
Hydrocarbons absorbed by bromine ..		5·20	per cent.
Durability of 1 cubic foot by 5 in. jet flame		40	min. 28 sec.
Value of 1 cubic foot of gas in sperm ..		439·68	grains
Value of gas from 1 ton of coal in sperm ..		687·47	lb.
Illuminating power of gas in standard candles (per London Argand)		18·32	candles
Sulphuretted hydrogen (H_2S) in foul gas		1·75	per cent.
Carbonic acid (CO_2) in foul gas		5·25	per cent.
Carbonic oxide (CO) in foul gas		8·50	per cent.
Sulphur eliminated with volatile products		13·21	lb.
Liquid products—			
Tar per ton of coal		14·75	gallons
Ammoniacal liquor per ton of coal ..		28·75	gallons
Strength of ammoniacal liquor		2·75	degs. Twaddell
Hygrometric water per ton of coal ..		15·36	gallons
Aqueous absorbent capacity of coal (determined by complete saturation)		10·42	per cent.

Notes.

AYRSHIRE.

McNaught Caprington Coal—*cont.*

Solid products—

Coke per ton of coal	1,252·16 lb.
Carbon in the coke	92·60 per cent.
Ash in the coke	7·40 per cent.
Sulphur in coke per ton of coal	4·48 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)..	12·72 per cent.

While yielding a good average volume of 18·32-candle gas, this coal affords 11·18 cwt. of excellent coke per ton. Owing to the amount of calcium carbonate in the coal, the foul gas contains fully the average percentage of carbonic acid. Compared with Main Lesmahagow cannel coal represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas and 1,535·5 lb. of sperm value per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 46·31.

Analyst—Geo. R. Hislop, F.C.S., &c.

Date of Analysis—December 25, 1901.

Colliery—CAPRINGTON, Parrot Seam, No. 42 Pit.

Caprington Cannel Coal.

Class of Coal—Gas.

The coal is black, possesses considerable lustre and brown streak; fracture inclines to slaty undulating, and in part scalariform with impressions of stigmaria; cross-fracture conchoidal, partly angular, and containing some deposits of ferric bisulphide, calcium carbonate, and coating of fireclay in the natural partings; moderately cohesive and compact; under distillation it slightly intumesces; colour of ash, pale brown; thickness of seam, 10 in., and of very uniform density, mean specific gravity being 1·263 (water = 1·000); weight of 1 cubic foot, 78·93 lb.

		Per cent.
Volatile matters (containing 0·56 of sulphur)..		37·40
Coke, consisting of—		
Carbon	48·27	
Sulphur	0·23	
Ash	8·30	
		56·80
Water expelled at 212 degs. Fahr.		5·80
		100·00

AYRSHIRE.

Notes.

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	11,320 cubic feet
Gas from 1 cubic foot of the coal	398·88 cubic feet
Specific gravity of the gas	·540 (air 1·000)
Hydrocarbons absorbed by bromine ..	9·20 per cent.
Durability of 1 cubic foot by 5 in. jet flame	56 min. 18 sec.
Value of 1 cubic foot of gas in sperm ..	655·92 grains
Value of gas from 1 ton of coal in sperm ..	1,060·71 lb.
Illuminating power of gas in standard candles	27·33 candles
Sulphuretted hydrogen (H_2S) in foul gas	2·00 per cent.
Carbonic acid (CO_2) in foul gas	4·00 per cent.
Carbonic oxide (CO) in foul gas	9·20 per cent.
Sulphur eliminated with volatile products	12·54 lb.
Liquid products—	
Tar per ton of coal	17·15 gallons
Ammoniacal liquor per ton of coal ..	22·50 gallons
Strength of ammoniacal liquor	2·50 degs. Twaddell
Hygrometric water per ton of coal ..	12·99 gallons
Aqueous absorbent capacity of coal (determined by complete saturation) ..	7·56 per cent.
Solid products—	
Coke per ton of coal	1,272·32 lb.
Carbon in the coke	85·40 per cent.
Ash in the coke	14·60 per cent.
Sulphur in coke per ton of coal	5·15 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	11·73 lb.

This is an excellent second-class cannel coal. It is easily distilled, yields a considerable volume of 27·33 candle gas, and affords 11·36 cwt. of medium quality coke per ton. The coal contains about the average amounts of water and sulphur. Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas, and 1,535·5 lb. of sperm value per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 66·70.

Analyst—Geo. R. Hislop, F.C.S., &c.
Date of Analysis—March 14, 1900.

Notes.

AYRSHIRE.

Colliery—CAPRINGTON, ... Seam, No. 41 Pit.

Anthracite or Blind Coal.

Class of Coal—Anthracite.

	Per cent.
Fixed carbon	83·9
Volatile matters	11·1
Ash	3·2
Water	1·8
	100·00

Coke	87·10 per cent.
Sulphur	0·54
Specific gravity	1·367
Weight of cubic foot	85 lb.
Heating power, pounds of water at 212 degs. F. evaporated by 1 lb. of coal	11·5 lb.

This anthracite is of superior quality.

Analyst—Dr. Wm. Wallace.

Date of Analysis—1860.

A. FINNIE AND SON,

Kilmarnock.

Colliery—FERGUSHILL, Ell, Stone, Main, Turf, Lady Ha', and Wee Seams, Nos. 22, 23, 26, 28, 30 Pits.

Shipping Port—Ardrossan.

Rail—Kilwinning, Kilwinning Station.

Canal—None.

Fergushill Coals.

Class of Coal—Steam.

	Fergushill, Kilwinning.		
	Ell.	Stone.	Main.
Specific gravity	1·27	1·22	1·30
Yield of coke, per cent.	63·91	61·43	60·13
Coke from 1 lb. of coal converts water into steam	8·30	8·30	7·76
Composition in 100 parts—			
Carbon	80·77	75·07	75·78
Hydrogen	5·28	5·35	5·53
Oxygen	8·09	13·19	12·02
Nitrogen	1·33	1·13	1·06
Sulphur	1·14	1·88	1·65
Ash	3·39	3·38	3·96

Analysts—Hy. K. Bamber, F.C.S.

Date of Analysis—May 1, 1862.

Notes.

AYRSHIRE.

Fergushill Cannel Coal.

Class of Coal—Gas.

A sample of this coal, representing the entire product of the seam, gave on examination the following results:—

The coal is black, possesses considerable lustre and brown streak; fracture irregular and partly scalariform; one half of seam highly resinoid and of bright lustre, with considerable deposits of calcic carbonate; rather friable and porous; on the fire it intumesces and agglomerates; colour of ash, pale brown and flocculent; thickness of seam, 9 in.; mean specific gravity, 1·225 (water 1·000); weight of 1 cubic foot, 76·56 lb.

		Per cent.
Volatile matters (containing 0·44 of sulphur)		37·67
Coke, consisting of—		
Carbon	51·65	
Sulphur	0·18	
Ash	2·85	
		54·68
Water expelled at 212 degs. Fahr. ..		7·65
		100·00

Gaseous products—	
Gas per ton of coal at 60 degs. F., and 30 in. bar.	10,750 cubic feet
Gas from 1 cubic foot of the coal	367·42 cubic feet
Specific gravity of the gas	·571 (air 1·000)
Hydrocarbons absorbed by bromine	8·50 per cent.
Durability of 1 cubic foot by 5 in. jet flame ..	49 min. 38 sec.
Value of 1 cubic foot of gas in sperm	578·80 grains
Value of gas from 1 ton of coal in sperm ..	888·99 lb.
Illuminating power of gas in standard candles	24·12 candles
Sulphuretted hydrogen (H_2S) in foul gas ..	1·25 per cent.
Carbonic acid (CO_2) in foul gas	2·75 per cent.
Carbonic oxide (CO) in foul gas	9·75 per cent.
Sulphur eliminated with volatile products ..	9·85 lb.
Liquid products—	
Tar per ton of coal	15·90 gallons
Ammoniacal liquor per ton of coal	31·31 gallons
Strength of ammoniacal liquor	2·25 degs. Twadd.
Hygrometric water per ton of coal	17·13 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	9·85 per cent.
Solid products—	
Coke per ton of coal	1,224·83 lb.
Carbon in the coke	94·80 per cent.
Ash in the coke	5·20 per cent.
Sulphur in coke, per ton of coal	4·03 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	13·02 lb.

Notes.

AYRSHIRE.

Fergushill Cannel Coal—*cont.*

This is an excellent coal of its class for the production of gas and coke. It is easily distilled, and contains a moderate amount of impurities. Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 64·92.

Analyst—Geo. R. Hislop, F.C.S., F.I.Inst., F.R.S.S.A.
Date of Analysis—April 27, 1893.

Fergushill Shale.

Class of Coal—Gas.

A sample of this shale, representing the entire product of the seam, gave on examination the following results:—

The shale inclines to brownish black, with slight lustre and brown streak; fracture highly slaty with some small nodules of ferric carbonate; cross-fracture angular and partly semi-conchoidal, with slight deposits of calcic carbonate; moderately cohesive, but very compact; thickness of seam, 6 in.; mean specific gravity, 1·515 (water 1·000); weight of 1 cubic foot, 94·68 lb.

		Per cent.
Volatile matters (containing 0·52 of sulphur) ..		31·04
Coke, consisting of—		
Carbon	21·72	
Sulphur	0·36	
Ash	44·64	
		66·72
Water expelled at 212 degs Fahr... ..		2·24
		100·00

Gaseous products—

Gas per ton of shale at 60 degs. Fahr., and 30 in. bar	10,075 cubic feet
Gas from 1 cubic foot of the shale.. ..	425·84 cubic feet
Specific gravity of the gas	·578 (air 1·000)
Hydrocarbons absorbed by bromine ..	10·75 per cent.
Durability of 1 cubic foot by 5 in. jet flame	63 min. 18 sec.
Value of 1 cubic foot of gas in sperm ..	728·64 grains
Value of gas from 1 ton of shale in sperm	1,048·72 lb.
Illuminating power of gas in standard candles	30·36 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·25 per cent.
Carbonic acid (CO_2) in foul gas	3·25 per cent.
Carbonic oxide (CO) in foul gas	11·00 per cent.
Sulphur eliminated with volatile products	11·65 lb.

Notes.

AYRSHIRE.

Liquid products—	
Tar per ton of shale	13·25 gallons
Ammoniacal liquor per ton of shale ..	8·75 gallons
Strength of ammoniacal liquor	3·50 degs. Twadd.
Hygrometric water per ton of shale ..	5·01 gallons
Aqueous absorbent capacity of shale (determined by complete saturation) ..	2·50 per cent.
Solid products—	
Coke per ton of shale	1,494·52 lb.
Carbon in the coke	33·10 per cent.
Ash in the coke	66·90 per cent.
Sulphur in coke per ton of shale	8·06 lb.
Heating power of 1 lb. of coke (water from boiling point into steam) ..	4·54 lb.

This shale is easily distilled, and yields a moderate volume of 30·36 candle gas. It is very dry, and the foul gas contains a moderate percentage of impurities. Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas and 1,535·5 lb. of sperm value per ton, and having regard also to the value of the secondary products, and the cost of the purification of the gas), this shale is equal to 56·27.

Analyst—Geo. R. Hislop, F.C.S., M.S.C.Ind., F.R.S.S.A.
Date of Analysis—September 29, 1900.

Colliery—SPRINGHILL, McNaught, Tourha, Main, Splint and Ell Seams, Nos. 1, 2, 3 and 4 Springhill Pits, and Cauldhame Pit.
Shipping Port—Irvine.
Rail—Preghorn, Springside Station.
Canal—None.

Springhill Ell Coal.

Class of Coal—Gas.

A sample of this coal, representing the entire product of the seam, gave on examination the following results :—

The coal possesses considerable lustre and brown streak; fracture defined by laminæ of charcoal; cross-fracture angular and partly resinoid with considerable deposits of calcic carbonate and traces of ferric bisulphide; moderately cohesive but porous; under distillation it intumesces and agglomerates; colour of ash, pale brown; thickness of seam, 24 in., including a 3 in. band of brown splint coal; density, very uniform; mean specific gravity being 1·240 (water 1·000); weight of 1 cubic foot, 77·5 lb.

Notes.

AYRSHIRE.

Springhill Ell Coal—*cont.*		Per cent.
Volatile matters (containing 0·45 sulphur)		34·85
Coke, consisting of—		
Carbon	52·26	
Sulphur	0·21	
Ash	4·48	
		56·95
Water expelled at 212 degs. Fahr. ..		8·20
		100·00

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	10,830 cubic feet
Gas from 1 cubic foot of the coal	374·70 cubic feet
Specific gravity of the gas	·484 (air 1·000)
Hydrocarbons absorbed by bromine ..	5·20 per cent.
Durability of 1 cubic foot by 5 in. jet flame	44 min. 38 sec.
Value of 1 cubic foot of gas in sperm ..	482·40 grains
Value of gas from 1 ton of coal in sperm	746·34 lb.
Illuminating power of gas in standard candles (per London Argand)	20·10 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·25 per cent.
Carbonic acid (CO_2) in foul gas	5·25 per cent.
Carbonic oxide (CO) in foul gas	5·75 per cent.
Sulphur eliminated with volatile products	10·08 lb.
Liquid products—	
Tar per ton of coal	15·50 gallons
Ammoniacal liquor per ton of coal ..	30·18 gallons
Strength of ammoniacal liquor	2·50 degs. Twadd.
Hygrometric water, per ton of coal ..	18·36 gallons
Aqueous absorbent capacity of coal (determined by complete saturation) ..	11·80 per cent.
Solid products—	
Coke per ton of coal	1,275·68 lb.
Carbon in the coke	92·14 per cent.
Ash in the coke	7·86 per cent.
Sulphur in coke per ton of coal	4·70 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	12·66 lb.

This coal yields about the average volume of gas from splint coals, and of grand quality, and at same time affords 11·39 cwt. of good coke per ton. It contains a very moderate percentage of sulphur, but fully the average amount of water and carbon dioxide. Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 51·43.

Analyst—Geo. R. Hislop, F.C.S., M.S.C.Ind., F.R.S.S.A.

Date of Analysis—May 6, 1905.

AYRSHIRE.

Notes.

GLENGARNOCK IRON AND STEEL COMPANY LIMITED,

127, St. Vincent Street, Glasgow.

Collieries—AUCHENHARVIE and ARDEER, ... Seam, ... Pit.

Shipping Ports—Ardrossan and Irvine.

Rail—Caledonian and Glasgow & South-Western, Stevenston Station.

Canal—None.

Auchenharvie Turf Coal, Ardeer Steam Coal.

Class of Coal— . . . .

	Auchenharvie Turf Coal. House. Per cent.	Ardeer Steam Coal. Steam. Per cent.
Fixed carbon	57·80	55·00
Volatile gases, tar, &c.	34·05	33·40
Ash	2·10	6·00
Moisture	6·05	5·60
	100·00	100·00

Analyst—Robert Faulds.

Date of Analysis—October, 1906.

LANEMARK COAL COMPANY LIMITED,

New Cumnock.

Colliery—LANEMARK, Lanemark Cannel Seam, Lanemark Pit.

Shipping Port—Ayr.

Rail—Glasgow and South-Western, New Cumnock Station.

Canal—None.

Lanemark Cannel Coal.

Class of Coal—Gas.

Purified gas per ton	10,602 cubic feet
Illuminating power	29·23 sperm candles
Value of 1 cubic foot of gas	701·50 grains sperm
Value of gas from 1 ton of coal	1,062·30 lb. sperm
Specific gravity of gas (air 1·000)	·574
Yield of coke per ton of coal	1,241 lb.
Percentage of carbon in coke	89·50 per cent.

Analyst—Alexander Bell.

Date of Analysis—February 29, 1892.

Notes.

AYRSHIRE.

A. G. MOORE AND CO.,

142, St. Vincent Street, Glasgow.

Colliery—SHIELDMAINS, Main Coal Seam, Shieldmains Pit.

Shipping Port—Ayr.

Rail—Glasgow and South-Western, Drongan Station.

Canal— . . . .

Shieldmains Gas Coal.

Class of Coal—Gas.

A practical test made with one truckload at the Kilmarnock Gasworks gave the following results:—

	Cubic feet of gas.
First test of ½ cwt. coal produced	233
Second test of ½ cwt. coal produced	235
Total for 1 cwt. coal	468

This being at the rate of 9,360 cubic feet per ton of coal.

The average illuminating power of gas is about equal to 22 sperm candles. The coke is very good, containing only 5 per cent. of ash.

Analyst—H. Fairweather.

Date of Analysis—September 1, 1904.

Shieldmains House Coal.

Class of Coal—House, Steam.

	Per cent.	Per cent.
Volatile matter—		
Gas, tar, &c.	40·41	
Sulphur	0·44	
Water	3·05	
		43·90
Coke—		
Fixed carbon	52·44	
Sulphur	0·56	
Ash	3·10	
		56·10
		100·00

Heating power, practical, Playfair's formula (pounds of water at 212 degs. Fahr. evaporated by 1 lb. of coal)	8·07 lb.
Specific gravity	1·28
Weight of 1 cubic foot	80·00 lb.

These results show that this is an excellent coal in every respect, either for house or light steam purposes. Being remarkably free from ash, and even from sulphur, it is an exceedingly clean coal, and in every way well adapted for the purposes named.

Analysts—R. R. Tatlock and Thomson.

Date of Analysis—August 15, 1901.

Notes.

CLACKMANNAN.

ALLOA COAL COMPANY LIMITED,

Alloa.

Colliery—ALLOA, Five-foot and Splint Seams, Alloa, Devon, Tillicoultry, Sheriffyard and Brucefield Pits.
Shipping Port—Alloa.
Rail—North British and Caledonian, Alloa Station.
Canal—None.

Alloa Jewel Coal.

Class of Coal—Steam.

A. Mean specific gravity of the coal (water = 1·000) .. .. 1·259
Weight of 1 cubic foot of the coal .. .. $78\frac{1}{2}$ lb.

B. Proximate analysis.—When heated the coal yields—

	Per cent.
Volatile combustible matter ..	36·93
Fixed carbon	55·61
Ash	1·16
Sulphur	0·58
Moisture	5·72
	100·00
Coke	57·06

Weight of ash in 1 ton of coal .. .. 25·98 lb.
Weight of sulphur in 1 ton of coal .. 12·99 lb.

C. Ultimate analysis.—Constituents of the coal—

	Per cent.
Carbon	78·19
Hydrogen	6·29
Nitrogen	1·49
Oxygen	6·57
Sulphur	0·58
Ash	1·16
Moisture	5·72
	100·00

D. The calorific or heat-producing power of the coal with the foregoing analysis is as follows:—

1 lb. weight of the coal during perfect combustion evolves heat sufficient to raise 14·016 lb. of water, 1 deg. Fahr. in temperature.

Notes.

CLACKMANNAN.

Alloa Jewel Coal—*cont.*

Equal to 77·87 lb. (77⅘) of water, from 32 to 212 degs. Fahr.,
or to 93·44 lb. (93½) „ „ 62 to 212 degs. Fahr.,
or to 12·57 lb. (12½) „ „ 62 to 212 degs. Fahr., and thence into steam,
or to 14·53 lb. (14½) „ „ 212 degs. Fahr. into steam.

This is an excellent steam coal. The ash is very small, and the true combustible elements—carbon and hydrogen—are very large. In all respects it is a first class fuel for raising steam. In practical work, and allowing for imperfect combustion and loss of heat in ordinary furnaces, 1 lb. of the coal will evaporate fully 9 lb. of water into steam. Whilst it burns readily and gives off inflammable gas, it leaves a large proportion of brightly glowing cinders or coke which comes away, leaving a slight amount of ash. It is a very clean and free-burning steam coal.

Analyst—Stevenson McAdam, Ph.D., &c.
Date of Analysis—May 7, 1878.

Alloa Splint Steam Coal.

Class of Coal—Steam.

A. Mean specific gravity of the coal (water = 1·000) .. .. 1·273
Weight of 1 cubic foot of the coal .. .. 79⅜ lb.

B. Proximate analysis.—When heated the coal yields—

	Per cent.
Volatile combustible matter ..	35·85
Fixed carbon	54·79
Ash	4·46
Sulphur	0·34
Moisture	4·56
	100·00
Coke	59·42
Weight of ash in 1 ton of coal	99·9 lb.
Weight of sulphur in 1 ton of coal	7·61 lb.

C. Ultimate analysis.—Constituents of the coal—

	Per cent.
Carbon	76·48
Hydrogen	6·18
Nitrogen	1·52
Oxygen	6·46
Sulphur	0·34
Ash	4·46
Moisture	4·56
	100·00

Clackmannan.

Notes.

D. The calorific or heat-producing power of the coal with the foregoing analysis is as follows--

1 lb. of the coal during perfect combustion evolves heat sufficient to raise 13·575 lb. of water 1 deg. Fahr. in temperature.

Equal to 75·42 lb. ($75\frac{1}{2}$) of water from 32 to 212 degs. Fahr.,
or to 90·50 lb. ($90\frac{1}{2}$) „ „ 62 to 212 degs. Fahr.,
or to 12·18 lb. ($12\frac{1}{6}$) „ „ 62 to 212 degs. Fahr., and thence into steam.
or to 14·07 lb. (14) „ „ 212 degs. Fahr. into steam.

The coal is of excellent quality for the raising of steam. The proportion of ash in the coal is small, and there is a high percentage of carbon and hydrogen, which are the true heat-producing constituents of the coal. When used in furnaces the coal inflames readily, gives off inflammable gases, and then leaves an excellent coke, which continues to burn and evolve a high heat. Making due allowance for loss of heat in ordinary furnaces by the chimney and through imperfect combustion of the coal, the coal may be depended upon for the evaporation of 9 lb. of boiling water into steam during the combustion of each pound of coal.

Analyst—Stevenson McAdam, Ph.D., &c.
Date of Analysis—May 7, 1878.

Notes.

DUMBARTON.

J. AND A. F. WALLACE,

Kirkintilloch.

Colliery—WESTER GARTSHORE, Main Coal Seam, No. 2 Pit.
Shipping Ports—Queen's Dock and Bo'ness.
Rail—North British, Wester Gartshore Siding.
Canal—Forth and Clyde.

Wester Gartshore Steam Coals.

Class of Coal—Steam and Manufacturing.

	Main Coal. No. 1 Pit. Per cent.	Main Coal. No. 2 Pit. Per cent.	Wee Coal. No. 2 Pit. Per cent.
Volatile matters—			
Gas, tar, &c.	17·03	22·00	23·86
Sulphur	0·15	0·08	0·30
Water at 212 degs. Fahr.	2·46	2·31	2·14
Coke—			
Fixed carbon	77·19	73·39	69·52
Sulphur	0·16	0·06	0·43
Ash	3·01	2·16	3·75
	100·00	100·00	100·00
Volatile matter	19·64	24·39	26·3
Coke (dry)	80·36	75·61	73·7
Coke per ton of coal	16 c. 8 lb.	15 c. 13 lb.	14 c. 2 q. 27 lb.
Specific gravity of the coal	1·260	1·265	1·255
Weight of cubic foot	78½	79	78 lb.
Stowage space per ton	42·8	42·5	43 cubic ft.
Heating power (practical) in pounds of water at 212 degs. Fahr., converted into steam by the combustion of 1 lb. of coal	10·56	10·22	9·77 lb.

Composition of the coke (dry)—

	Main No. 1. Per cent.	Main No. 2. Per cent.	Wee No. 2. Per cent.
Carbonaceous or combustible matter	96·05	97·07	94·33
Sulphur	0·20	0·08	0·58
Ash	3·75	2·85	5·09
	100·00	100·00	100·00

Analyst—William Wallace.

Date of Analysis—November 26, 1878.

Notes.

DUMBARTON.

Another analysis of these coals by a firm of chemical manufacturers shows—

	Main No. 1. Per cent.	Main No. 2. Per cent.	Wee No. 2. Per cent.
Volatile matter	18·6	20·65	21·0
Fixed carbon	76·8	75·60	72·4
Ash	3·0	2·00	6·0
Water	1·6	1·75	0·6
	100·0	100·00	100·0

Analyst—William Wallace.

Date of Analysis—November 26, 1878.

Colliery—WESTER GARTSHORE, Coking Coal (Kilsyth) Seam, No. 1 Pit.

Waterside Best House Coal and Nuts.

Class of Coal—Gas, Steam, and House.

		Per cent.
Proximate analysis—		
Volatile matters—		
Gas, tar, &c.	31·47	
Sulphur	0·29	
Water, at 212 degs. Fahr.	2·16	
		33·92
Coke—		
Fixed carbon	63·60	
Sulphur	0·36	
Ash	2·12	
		66·08
		100·00

Coke per ton of coal	1,480 lb., or 13 cwt. 24 lb.
Specific gravity	1·280
Weight of 1 cubic foot	80 lb.
Space required for stowage, per ton	42 cubic feet

Analysis of the coke (dry)—	Per cent.
Carbonaceous or combustible matter	96·25
Sulphur	0·54
Ash	3·21
	100·00

Notes

DUMBARTON.

Waterside Best House Coal and Nuts—*cont.*

Ultimate analysis of the coal—	Per cent.
Carbon	80·95
Hydrogen	5·43
Oxygen	7·22
Nitrogen	1·47
Sulphur	0·65
Ash	2·12
Water, expelled at 212 degs. Fahr.	2·16
	100·00
Calorific or heating power, theoretical or absolute, in pounds of water, at 212 degs. Fahr., converted into steam by 1 lb. of coal	14·97 lb
Calorific or heating power, practical	9·25 lb.

Analyst—William Wallace.

Date of Analysis—August 6, 1886.

Coking Coal.

Class of Coal—Gas, Steam, and House.

	Top portion comprising 25 per cent. of seam.	Bottom portion. comprising 75 per cent. of seam.
Volatile matters—		
Gas, tar, &c.	33·04	31·68
Sulphur	0·24	0·28
Water, at 212 degs. Fahr.	2·21	2·26
Coke—		
Fixed carbon	62·71	64·39
Sulphur	0·30	0·33
Ash	1·50	1·06
	100·00	100·00
Volatile matters	35·49	34·22
Coke	64·51	65·78
Coke, per ton	1,445	1,473 lb.
	Cwt. qrs. lb.	Cwt. qrs. lb.
	or 12 3 17	13 0 17
Specific gravity	1·276	1·282
Weight per cubic foot	79½	80 lb.
Space required for stowage, per ton	42	42 c. ft.

Analyst—William Wallace.

Date of Analysis—August 6, 1886.

Notes.

DUMFRIESSHIRE.

SANQUHAR AND KIRKCONNEL COLLIERIES LIMITED,

Sanquhar.

Colliery—GATESIDE, Splint Seam, Gateside Pit.
Shipping Ports—Ayrshire Ports.
Rail—Glasgow and South-Western, Sanquhar Station.
Canal— . . . .

Gateside (Sanquhar) Splint Gas Coal.

Class of Coal—Gas, Steam, and Manufacturing.

A sample of this coal, representing the entire product of the seam, gave on examination the following results—

The coal is black to brownish black; possesses moderate to considerable lustre and brown streak; fracture partly slaty, laminated with brownish splint and bright bituminous coal; cross-fracture angular, coarse and partly resinoid, with deposits of ferric bisulphide and calcium carbonate; moderately cohesive and compact: under distillation it intumesces and agglomerates; colour of ash, pale brown; thickness of seam, 48 in., and of very uniform density, mean specific gravity being 1·229 (water 1·000); weight of 1 cubic foot, 76·83 lb.

		Per cent.	
Volatile matters (containing 0·38 of sulphur)		35·87	
Coke consisting of—			
Carbon	55·84		
Sulphur	0·20		
Ash	3·33		
		59·37	
Water expelled at 212 degs. Fahr.		4·76	
		100·00	
Gaseous products—			
Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.		11,505	cubic feet
Gas from 1 cubic foot of the coal		394·83	cubic feet
Specific gravity of the gas		·508	(air 1·000)
Hydrocarbons absorbed by bromine ..		6·50	per cent.
Durability of 1 cubic foot by 5 in. jet flame		52	min. 10 sec.
Value of 1 cubic foot of gas in sperm ..		578·40	grains
Value of gas from 1 ton of coal in sperm ..		950·64	lb.
Illuminating power of gas in standard candles		24·10	candles
Sulphuretted hydrogen (H_2S) in foul gas		1·00	per cent.
Carbonic acid (CO_2) in foul gas		2·75	per cent.
Carbon oxide (CO) in foul gas		5·25	per cent.
Sulphur eliminated with volatile products		8·57	per cent.

Notes.

DUMFRIESSHIRE.

Gateside (Sanquhar) Splint Gas Coal—*cont.*

Liquid products—

Tar per ton of coal	15·45	gallons
Ammoniacal liquor per ton of coal ..	23·13	gallons
Strength of ammoniacal liquor	2·50	degs. Twadd.
Hygrometric water per ton of coal ..	10·66	gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	7·60	per cent.

Solid products—

Coke per ton of coal	1,329·88	lb.
Carbon in the coke	94·40	per cent.
Ash in the coke	5·60	per cent.
Sulphur in coke per ton of coal	4·42	lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	12·97	lb.

This is one of the best gas and coke producing splint coals that I have examined; of gas it yields an unusually large volume of high candle-power, and of first-class coke 11·87 cwt. per ton. The coal at same time contains a minimum percentage of sulphur, and a moderate amount of water. Compared with Main Lesmahagow cannel coal represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas and 1,535·5 lb. of sperm value per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 67·94.

Analyst—Geo. R. Hislop, F.C.S.

Date of Analysis—April 29, 1902.

Colliery—FAULDHEAD, ... Seam, Fauldhead Pit.

Sanquhar Washed Nut Coal.

Class of Coal—Steam, Manufacturing, House.

A sample of this coal, representing the entire product of the seam, gave on examination the following results:—

The nuts are of size to pass through a screen from ½ in. to 1½ in. mesh and slightly dried; they possess considerable lustre and brownish-black streak; regular to intermittent fracture, with slight deposits of charcoal; cross-fracture, cubical and resinoid, with slight deposits of calcium carbonate; very clean and free from foreign matters; moderately cohesive; under distillation they intumesce and agglomerate; colour of ash, brown; mean specific gravity, 1·262 (water 1·000); weight of 1 cubic foot, 78·87 lb.

Notes.

DUMFRIESSHIRE.

		Per cent.
Volatile matters (containing 0·65 of sulphur)		34·67
Coke, consisting of—		
Carbon	54·05	
Sulphur	0·21	
Ash	3·47	
		57·73
Water expelled at 212 degs. Fahr. ..		7·60
		100·00

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar	11,150 cubic feet
Gas from 1 cubic foot of the coal	393·03 cubic feet
Specific gravity of the gas	·480 (air 1·000)
Hydrocarbons absorbed by bromine	5·25 per cent.
Durability of 1 cubic foot by 5 in. jet flame ..	46 min. 9 sec.
Value of 1 cubic foot of gas in sperm	470·40 grains
Value of gas from 1 ton of coal in sperm ..	749·28 lb.
Illuminating power of gas in standard candles (per London Argand)	19·60 candles
Sulphuretted hydrogen (H_2S) in foul gas ..	1·75 per cent.
Carbonic acid (CO_2) in foul gas	3·00 per cent.
Carbonic oxide (CO) in foul gas	6·25 per cent.
Sulphur eliminated with volatile products ..	14·56 per cent.
Liquid products—	
Tar per ton of coal	15·32 gallons
Ammoniacal liquor, per ton of coal	29·05 gallons
Strength of ammoniacal liquor	2·50 degs. Twadd.
Hygrometric water per ton of coal	17·02 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	10·85 per cent.
Solid products—	
Coke per ton of coal	1,293·15 lb.
Carbon in the coke	94·00 per cent.
Ash in the coke	6·00 per cent.
Sulphur in coke per ton of coal	4·70 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	12·91 lb.

The nuts yield a considerable volume of good gas, and at the same time afford 11·55 cwt. per ton of remarkably fine, porous and silvery coke, while the foul gas contains about the average amount of impurities. Compared with Main Lesmahagow cannel coal represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas, and 1,535·5 lb. of sperm value per ton, and having regard also to the value of the secondary products, and the cost of the purification of the gas), this coal is equal to 54·37.

Analyst—Geo. R. Hislop.

Date of Analysis—March 28, 1902.

Notes.

DUMFRIESSHIRE.

Colliery—FAULDHEAD, ... Seam, ... Pit.
Shipping Ports—Ayrshire Ports.
Rail—G. and S.W. Railway, Kirkconnel Station.
Canal— . . . . . .

Class of Coal—Coking, House, and Steam.

A sample of this coal, representing the entire product of the seam, gave on examination the following results:—

The coal possesses considerable lustre and brown streak. Fracture defined by deposits of charcoal; cross-fracture, cubical to angular, and largely resinoid, with deposits of calcic carbonate and traces of ferric bisulphide in the natural partings; moderately cohesive and porous; under distillation it intumesces and agglomerates; colour of ash, brown; mean specific gravity, 1·214 (water 1·000). Weight of 1 cubic foot, 75·88 lb.

		Per cent.
Volatile matters (containing 0·54 of sulphur)		34·82
Coke, consisting of—		
Carbon	54·28	
Sulphur	0·16	
Ash	2·51	
		56·95
Water expelled at 212 degs. Fahr... ..		8·23
		100·00

Gaseous products—

Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	10,730 cubic feet
Gas from 1 cubic foot of the coal	363·47 cubic feet
Specific gravity of the gas	·490
Hydrocarbons absorbed by bromine ..	5·25 per cent.
Durability of 1 cubic foot by 5 in. jet flame	46 min. 9 sec.
Value of 1 cubic foot of gas in sperm ..	509·04 grains
Value of gas from 1 ton of coal in sperm..	780·28 lb.
Illuminating power of gas in standard candles (per London Argand)	21·21 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·50 per cent.
Carbonic acid (CO_2) in foul gas	3·00 per cent.
Carbonic oxide (CO) in foul gas	6·50 per cent.
Sulphur eliminated with volatile products	12·10 lb

Notes.

DUMFRIESSHIRE.

Liquid products—	
Tar per ton of coal	15·60 gallons
Ammoniacal liquor, per ton of coal ..	32·45 gallons
Strength of ammoniacal liquor	2·50 degs. Twadd.
Hygrometric water per ton of coal ..	18·43 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	11·60 per cent.
Solid products—	
Coke per ton of coal	1,275·68 lb.
Carbon in the coke	95·60 per cent.
Ash in the coke	4·40 per cent.
Sulphur in coke per ton of coal	3·58 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)..	13·13 lb.

While yielding a good volume of gas of relatively high candle-power, this coal claims special recommendation on account of the high-class coke it affords; the impurities in the foul gas are, at the same time, of the average amount. Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas, and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products, and the cost of the purification of the gas), this coal is equal to 57·54.

Analyst—Geo. R. Hislop, F.C.S., M.S.C. Ind., F.R.S.S.A.

Date of Analysis—June 10, 1905.

Notes.

EDINBURGH.

ARNISTON COAL COMPANY LIMITED,

Gorebridge, Edinburgh.

Colliery—ARNISTON, ... Seam, Emily and Gore Pits.
Shipping Ports—Leith and Granton.
Rail— . . . . Gorebridge Station.
Canal—None.

Arniston Cannel Coal.

Class of Coal—Gas.

A sample of this coal, representing the entire product of the seam, gave on examination the following results :—

The coal is brownish black, possesses considerable and strong brown streak; fracture, rather irregular and undulating, with impressions of stigmaria; cross-fracture, semi-conchoidal to angular, with deposits of ferric bisulphide and calcium carbonate; very cohesive and compact; on the fire it partially intumesces and agglomerates; colour of ash, pale brown; thickness of seam, 8 in.; mean specific gravity, 1·292 (water 1·000); weight of 1 cubic foot, 74·50 lb.

		Per cent.
Volatile matters (containing 0·69 of sulphur)		52·88
Coke, consisting of—		
Carbon	42·48	
Sulphur	0·22	
Ash	3·10	
		45·80
Water expelled at 212 degs. Fahr... ..		1·32
		100·00

Gaseous products—

Gas per ton of coal at 60 degs. Fahr., and 30 in. bar.	14,135	cubic feet
Gas from 1 cubic foot of the coal	470·11	cubic feet
Specific gravity of the gas	·696	(air 1·000)
Hydrocarbons absorbed by bromine ..	15·25	per cent.
Durability of 1 cubic foot by 5 in. jet flame	70	min. 48 sec.
Value of 1 cubic foot of gas in sperm ..	896·64	grains
Value of gas from 1 ton of coal in sperm..	1,810·57	lb.
Illuminating power of gas in standard candles	37·36	candles
Sulphuretted hydrogen (H_2S) in foul gas	2·00	per cent.
Carbonic acid (CO_2) in foul gas	2·25	per cent.
Carbonic oxide (CO) in foul gas	7·50	per cent.
Sulphur eliminated with volatile products	15·46	lb.

EDINBURGH.

Notes.

Liquid products—

Tar per ton of coal	28·85	gallons
Ammoniacal liquor per ton of coal ..	5·25	gallons
Strength of ammoniacal liquor	3·60	degs. Twadd.
Hygrometric water per ton of coal.. ..	2·95	gallons
Aqueous absorbent capacity of coal (determined by complete saturation).. ..	1·50	per cent.

Solid products—

Coke per ton of coal..	1,025·92	lb.
Carbon in the coke	93·24	per cent.
Ash in the coke	6·76	per cent.
Sulphur in coke per ton of coal	4·92	lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	12·81	lb.

This is an exceptionally rich cannel coal, yielding as it does a sperm value of illuminating matter equal to 1,810½ lb. per ton, and at same time affords 9·16 cwt. of excellent coke per ton. The coal, moreover, is easily distilled at a good heat, and the foul gas contains about the average total impurities. Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas, and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products, and the cost of the purification of the gas), this coal is equal to 124·13.

Analyst—Geo. R. Hislop, F.C.S., F.R.S.S.A., F.I.Inst.
Date of Analysis—June 20, 1896.

Arniston Steam Coal.

Class of Coal—Steam.

	Composition per cent.	Composition per cent. exclusive of sulphur, ash, and water.
Carbon	73·13	84·66
Hydrogen	4·96	5·74
Oxygen	6·93	8·02
Nitrogen	1·36	1·58
Sulphur	1·08	—
Ash	2·72	—
Water	9·82	—
	100·00	100·00

Specific gravity, 1·265, water at 60 Fahr. being 1·000; colour of ash, pinkish; nature of coal, caking; coke, 63·60 per cent.; small bulk, dull in appearance, but fairly hard and coherent; total heat units (Favre

Notes.

EDINBURGH.

Arniston Steam Coal—*cont.*

and Silverman), 7,269; calorific power (Thompson), 7.029 calories; evaporative power (determined by Thompson's calorimeter), 13·09 lb. of water per pound of coal.

This coal is of a bituminous nature. The amount of ash is fairly low and satisfactory, and the proportion of sulphur moderate.

Analyst—Thomas Hughes, F.I.C., F.C.S.

Date of Analysis—June 4, 1902.

WM. BLACK,

Penicuik,

Colliery—PENICUIK, ... Seam, Mauricewood Pit.

Shipping Port—Leith.

Rail— . . . . Station.

Canal— . . . . . .

Corbie Jewel House Coal.

Class of Coal—House.

The coal is black, possesses considerable lustre and brown to brownish-black streak; fracture intermittent and partly laminated; cross-fracture angular to cubical and largely resinoid, with deposits of calcium carbonate and slight deposits of ferric bisulphide; moderately cohesive but porous. On the fire it intumesces slightly. Colour of ash, strong brown. Thickness of seam, 51 in., and of very uniform density. Mean specific gravity, 1·216 (water 1·000); weight of 1 cubic foot, 76·0 lb.

	Per cent.	Lb. per ton
Volatile matters	33·59	752·416
Fixed carbon	53·38	1,195·712
Ash	2·94	65·856
Sulphur	0·59	13·216
Moisture	9·50	212·800
	100·00	2,240·000

The calorific power of the coal (as determined by Thomson's calorimeter), 1 lb. of the coal by perfect combustion evolves sufficient heat to convert 13·5 lb. of water from 212 degs. Fahr. into steam; 1 lb. will therefore raise 13,041 lb. of water 1 deg. Fahr. in temperature.

Analyst—Geo. R. Hislop, F.C.S., &c.

Date of Analysis—April 17, 1902.

EDINBURGH. *Notes.*

Corbie Splint Coal.

Class of Coal—House and Gas.

A sample of this coal, representing the entire product of the seam, was examined and gave the following results :—

The coal is black to brown and brownish-black with moderate lustre; fracture slaty and coarse; cross-fracture angular and in part semi-conchoidal, with slight deposits of calcium carbonate and ferric bisulphide; very cohesive, but rather porous. Under distillation it partly and slightly intumesces. Colour of ash, pale brown; thickness of seam, 29 in.; mean specific gravity, 1·258 (water 1·000); weight of 1 cubic foot, 78·62 lb.

		Per cent.
Volatile matters (containing 0·56 of sulphur)		38·34
Coke, consisting of—		
Carbon	48·39	
Sulphur	0·17	
Ash	4·00	
		52·56
Water expelled at 212 degs. Fahr. ..		9·10
		100·00

Gaseous products—		
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar.	10,750	cubic feet
Gas from 1 cubic foot of the coal	377·30	cubic feet
Specific gravity of the gas	·521	(air 1·000)
Hydrocarbons absorbed by bromine ..	6·75	per cent.
Durability of 1 cubic foot by 5 in. jet flame	52	min. 20 sec.
Value of 1 cubic foot of gas in sperm ..	562·80	grains
Value of gas from 1 ton of gas in sperm ..	864·25	lb.
Illuminating power of gas in standard candles (per Union jet)	23·45	candles
Sulphuretted hydrogen (H_2S) in foul gas	1·50	per cent.
Carbonic acid (CO_2) in foul gas	4·50	per cent.
Carbonic oxide (CO) in foul gas	7·75	per cent.
Sulphur eliminated with volatile products	12·54	lb.
Liquid products—		
Tar per ton of coal	17·50	gallons
Ammoniacal liquor per ton of coal	34·42	gallons
Strength of ammoniacal liquor	2·25	degs. Twadd.
Hygrometric water per ton of coal ..	20·38	gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	12·24	per cent.

Notes.

EDINBURGH.

Corbie Splint Coal—*cont.*

Solid products—

Coke per ton of coal	1,177·34	lb.
Carbon in the coke	92·40	per cent.
Ash in the coke	7·60	per cent.
Sulphur in coke per ton of coal	3·81	lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	12·69	lb.

This is an excellent splint coal, and as such yields a large amount of illuminating matter per ton, and at same time affords 10·51 cwt. per ton of excellent coke. Compared with Main Lesmahagow cannel coal represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas, and 1,535·5 lb. of sperm value per ton, and having regard also to the value of the secondary products, and the cost of the purification of the gas) this coal is equal to 57·75.

Analyst—Geo. R. Hislop, F.C.S., &c.
Date of Analysis—March 29, 1902.

LOTHIAN COAL COMPANY LIMITED,

Rosewell.

Colliery—WHITEHILL, Splint Coal Seam, Whitehill Pit.
Shipping Port—Leith.
Rail—North British, Hawthornden Station.
Canal—None.

Whitehill Splint Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

		Per cent.
Volatile matters (containing 0·23 sulphur)		38·78
Coke—		
Fixed carbon	48·34	
Sulphur	0·44	
Ash	2·16	
		50·94
Water expelled at 212 degs. Fahr... ..		10·28
		100·00

Gaseous products—

Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	9,992 cubic feet
Gas from 1 cubic foot of coal	365·2 cubic feet
Hydrocarbons absorbed by bromine ..	4·8 per cent.
Illuminating power in standard sperm candles	15·99 candles
Durability of 1 cubic foot by in. jet flame	38 min. 10 sec.
Equivalent of 1 cubic foot in sperm ..	383·7 grains
Equivalent of 1 ton of coal in sperm ..	547·7 lb.
Sulphur in gas from 1 ton of coal	5·15 lb.

EDINBURGH.

Notes.

Liquid products—	
Tar per ton of coal	18 gallons
Ammoniacal liquor (including liquor from washers)	44·5 gallons
Strength of liquor by acid test	4·75 oz.
Solid products—	
Coke per ton of coal	1,312 lb.
	Per cent.
Carbon in coke	94·98
Sulphur	0·86
Ash	4·16
	100·00
Specific gravity of the coal	1·310
Weight of 1 cubic foot	81·875 lb.

Analyst—Robert Mitchell.
Date of Analysis—April 3, 1889.

Colliery—WHITEHILL, Jewel Coal Seam, Whitehill Pit.

Whitehill Jewel Coal.

Class of Coal—House.

		Per cent.
Volatile matters (containing 0·26 sulphur)		27·77
Coke—		
Fixed carbon	55·60	
Sulphur	0·28	
Ash	3·94	
		59·82
Water expelled at 212 degs. Fahr. ..		12·41
		100·00

Solid products—	
Coke per ton of coal	1,339 lb.
	Per cent.
Carbon in coke	92·94
Sulphur	0·46
Ash	6·60
	100·00

Analyst—Stephenson MacAdam, F.R.S.E., Ph.D., etc.
Date of Analysis—November 3, 1897.

Notes.

EDINBURGH.

Colliery—POLTON, Splint Coal Seam, No. 2 Pit.

Polton Splint Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

		Per cent.
Volatile matters (containing 0·24 sulphur)		32·21
Coke—		
Fixed carbon	48·95	
Sulphur	0·62	
Ash	4·56	
		54·13
Water expelled at 212 degs. Fahr. ..		13·66
		100·00

Solid products—	
Coke per ton of coal	1,212 lb.
	Per cent.
Carbon in coke	90·43
Sulphur	1·15
Ash	8·42
	100·00
Yield of gas per ton	10,388 cubic feet
Illuminating power of gas	13·95 candles

Analyst—Stephenson MacAdam, Ph.D., etc.

Date of Analysis—November 3, 1897.

LOTHIAN COAL COMPANY LIMITED,

Newtongrange, Midlothian.

Colliery—NEWBATTLE, Splint Seam, Newbattle Pit.

Shipping Ports—Leith, Granton

Rail—North British, Lady Victoria Pit Siding, Hardengreen Station.

Canal—None.

Newbattle Splint Coal.

Class of Coal—Gas.

		Per cent.
Volatile matters (containing 0·03 sulphur)		30·07
Coke—		
Fixed carbon	57·66	
Sulphur	0·39	
Ash	1·59	
		59·64
Water expelled at 212 degs. Fahr... ..		10·29
		100·00

Notes.

Edinburgh.

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar.	10,520 cubic feet
Gas from 1 cubic foot of coal	368·6 cubic feet
Specific gravity of the gas	·536 (air=1·000)
Hydrocarbons absorbed by bromine ..	4 per cent.
Illuminating power in standard sperm candles	15·45 candles
Durability of 1 cubic foot by 5 in. jet flame	38 min.
Equivalent of 1 cubic foot in sperm ..	370·8 grains
Equivalent of 1 ton of coal in sperm ..	557·2 lb.
Sulphur in gas from 1 ton of coal ..	0·67 lb.
Liquid products—	
Tar per ton of coal	14 gallons
Ammoniacal liquor (including liquor from washers)	43·5 gallons
Strength of liquor by acid test	5 oz.
Solid products—	
Coke per ton of coal	1,360 lb.

	Per cent.
Carbon in coke	96·67
Ash	2·68
Sulphur	0·65
	100·00
Specific gravity of the coal	1·257
Weight of 1 cubic foot	78½ lb.

Analyst—Robert Mitchell.

Date of Analysis—December 17, 1889.

Colliery—NEWBATTLE, Jewel Seam, Newbattle Pits.

Newbattle Jewel Coal.

Class of Coal—House.

	Per cent
Volatile combustible matter ..	39·13
Fixed carbon	55·72
Ash	2·56
Sulphur	0·62
Moisture	1·97
	100·00
Coke	58·59

Notes.

EDINBURGH.

Newbattle Jewel Coal—*cont.*

The coal is of first-class quality as a household coal. It is hard and compact in quality, and is not liable to break down into dross. When kindled, it burns freely, evolving much combustible gas, and forms an excellent cinder or coke, which continues to consume away at a bright cherry heat, leaving only a slight amount of ash. This coal can be recommended for use where a first-class, clean-burning house coal is required.

Analyst—Stevenson MacAdam, F.R.S.E., etc.

Date of Analysis—September 22, 1887.

Colliery—NEWBATTLE, ... Seam, Newbattle Pits.

Newbattle Steam Coal.

Class of Coal—Steam.

Mean specific gravity of the coal (water = 1·000)	1·322
Weight of 1 cubic foot of the coal	82·38 lb.
Proximate analysis.—When heated the coal yields—	Per cent.
Volatile combustible matter	31·32
Fixed carbon	55·02
Ash	3·43
Sulphur	0·36
Moisture	9·87
	100·00
Coke	58·56 per cent.
Weight of coke per ton of the coal ..	1,311¾ lb. (11¾ cwt.)
Weight of ash per ton of the coal	$76\frac{8}{10}$ lb.
Weight of sulphur per ton of the coal ..	8 lb.
Examination of the coke—	Per cent.
Carbon	93·82
Sulphur	0·11
Oxygen, &c.	0·22
Ash	5·85
	100·00
Weight of ash per ton of coke	131 lb. ($1\frac{1}{10}$ cwt.)
Weight of sulphur per ton of coke ..	2·46 lb. (2½ lb.)

Notes.

Ultimate analysis.—Constituents of the coal—

	Per cent.
Carbon	74·25
Hydrogen	5·54
Nitrogen	0·78
Oxygen, &c.	5·77
Sulphur	0·36
Ash	3·43
Moisture	9·87
	100·00

Calorific or heat-producing power.—1 lb. of the coal during perfect combustion evolves heat sufficient to raise 12,915 lb. of water 1 degree Fahr. in temperature equal to—

71·75 lb. of water from 32 to 212 degs. F.,
86·10 lb. of water from 62 to 212 degs. F.,
11·58 lb. of water from 62 to 212 degs. F., and thence into steam, or to
13·38 lb. of water from 212 degs. F. into steam.

The above results show the Newbattle steam coal to be of high-class composition for steam-raising purposes. The sulphur is low in amount, and so distributed throughout the coal that it should be practically impossible for heating to take place; and the coal will be found a safe one to ship for long sea voyages. The coal does not readily break down or crumble, and the coke obtained, when heat is applied in closed vessels, is of high-class heating quality and low in ash. The ash contains only a trace of iron, and is not liable to clinker. The heating power is sufficient to raise 12,915 lb. of water 1 degree in temperature, or to raise 11½ lb. of water from 62 degs. Fahr. to the boiling point and thence into steam, or of 13⅓ lb. of water from the boiling point into steam.

The coal is of high-class quality for steam-raising, and it may be shipped with safety.

Analyst—W. Ivison MacAdam, F.R.S.E., F.I.C., F.C.S., etc.
Date of Analysis—April 28, 1894.

Colliery—NEWBATTLE, Cannel Seam, Newbattle Pits.

Newbattle Cannel Coal.

Class of Coal—Gas.

A sample of this coal, representing the entire product of the seam, gave on examination the following results—

The coal inclines to brownish black, possesses considerable lustre, and yellowish-brown streak; fracture generally inclines to slaty, but in part irregular to curly, with impressions of stigmaria; cross-fracture

Notes.

EDINBURGH.

Newbattle Cannel Coal—*cont.*

inclines to conchoidal, but partly angular to curly, with deposits of ferric bisulphide and calcium carbonate in the natural partings. Very cohesive and compact; on the fire it partly and very slightly intumesces, but does not agglomerate; colour of ash, brownish white; thickness of seam, 8 in.; mean specific gravity, 1·175 (water 1·000); weight of 1 cubic foot, 73·43 lb.

		Per cent.
Volatile matters (containing 0·56 of sulphur)		50·23
Coke, consisting of—		
Carbon	44·06	
Sulphur	0·24	
Ash	4·33	
		48·63
Water expelled at 212 degs. Fahr... ..		1·14
		100·00

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar...	13,720 cubic feet
Gas from 1 cubic foot of the coal	449·76 cubic feet
Specific gravity of the gas	·668 (air 1·000)
Hydrocarbons absorbed by bromine	14·66 per cent.
Durability of 1 cubic foot by 5 in. jet flame ..	68 min. 16 sec.
Value of 1 cubic foot of gas in sperm	845·76 grains
Value of gas from 1 ton of coal in sperm ..	1,708·03 lb.
Illuminating power of gas in standard candles	35·24 candles
Sulphuretted hydrogen (H_2S) in foul gas ..	1·25 per cent.
Carbonic acid (CO^2) in foul gas..	3·00 per cent.
Carbonic oxide (CO) in foul gas	8·00 per cent.
Sulphur eliminated with volatile products ..	12·54 lb.
Liquid products—	
Tar per ton of coal	28·80 gallons
Ammoniacal liquor per ton of coal	4·38 gallons
Strength of ammoniacal liquor	3·60 degs. Twadd.
Hygrometric water per ton of coal	2·55 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	1·58 per cent.
Solid products—	
Coke per ton of coal	1,089·31 lb.
Carbon in the coke	91·10 per cent.
Ash in the coke	8·90 per cent.
Sulphur in the coke per ton of coal	5·38 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	12·51 lb.

EDINBURGH.

Notes.

This is a very rich cannel coal; it is easily distilled and yields a large volume of 35·24-candle gas, and affords 9·72 cwt. of good coke per ton. The foul gas at same time contains a moderate percentage of impurities. Compared with Main Lesmahagow cannel coal represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas, and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 112·73.

Analyst—Geo. R. Hislop, F.C.S., F.I.Inst., F.R.S.S.A.
Date of Analysis—September 3, 1895.

Colliery—NEWBATTLE, Parrot Bottoms Seam, Newbattle Pits.

Newbattle Parrot Bottoms Coal.

Class of Coal—Gas.

A sample of this coal gave on examination the following results—

Mean specific gravity		1·265 (water 1·000)
Weight of 1 cubic foot		79·06 lb.
		Per cent.
Volatile matters (containing 0·51 of sulphur) ..		36·55
Coke, consisting of—		
Carbon	52·86	
Sulphur	0·32	
Ash	3·35	
		56·53
Water expelled at 212 degs. Fahr.		6·92
		100·00

Gaseous products—

Gas per ton of coal at 60 degs. F., and 30 in. bar.	10,830 cubic feet
Gas from 1 cubic foot of coal	382·24 cubic feet
Hydrocarbons absorbed by bromine	7·6 per cent.
Durability of 1 cubic foot of gas in 5 in. jet flame	46 min. 10 sec.
Illuminating power of gas in standard candles	23·25 candles
Value of 1 cubic foot of gas in sperm	567·79 grains
Value of gas from 1 ton of coal in sperm ..	863·3 lb.
Sulphur eliminated with volatile products ..	11·42 lb.

Liquid products—

Tar per ton of coal	12·6 gallons
Ammoniacal liquor per ton of coal	16·4 gallons
Strength of ammoniacal liquor	3 degs. Twadd.
Hygrometric water per ton of coal	15·50 gallons

Notes.

EDINBURGH.

Newbattle Parrot Bottoms Coal—*cont.*

Solid products—

Coke per ton of coal	1,266 lb.
Carbon in the coke	94·02 per cent.
Ash in the coke	5·98 per cent.
Sulphur in coke, per ton of coal	7·16 lb.

The above results prove these Parrot Bottoms to be very suitable for gasmaking purposes, yielding 10,830 cubic feet of 23·24-candle gas. The coke is also of very good quality.

Analyst—Jas. D. Smith.

Date of Analysis—March 30, 1903.

A. G. MOORE AND CO.,

142, St. Vincent Street, Glasgow.

Colliery—DALKEITH, Great Seam, Smeatonshaw Pit.

Shipping Port—Leith.

Rail—North British, Smeaton Station.

Canal—None.

Dalkeith Splint Coal.

Class of Coal—Gas.

The coal possesses moderate lustre and brownish-black streak; fracture somewhat regular and partly splinty, with slight deposits of charcoal; cross fracture angular to cubical and partly resinoid, with deposits of calcium carbonate and ferric bisulphide; rather cohesive, but porous; under distillation it agglomerates and swells, the coke possessing a silvery lustre; ash flocculent and pale brown in colour; specific gravity, 1·245 (water 1·000); weight of 1 cubic foot, 77·81 lb.

		Per cent.
Volatile matters (containing 0·56 sulphur)		36·38
Coke, consisting of—		
Carbon	50·30	
Sulphur	0·21	
Ash	3·69	
		54·20
Water expelled at 212 degs. Fahr. ..		9·42
		100·00

Notes.

Edinburgh.

Gaseous products—

Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	10,830 cubic feet
Gas from 1 cubic foot of the coal	367·27 cubic feet
Specific gravity of the gas	·498 (air = 1·000)
Hydrocarbons absorbed by bromine ..	5·75 per cent.
Durability of 1 cubic foot by 5 in. jet flame	44 min. 45 sec.
Value of 1 cubic foot of gas in sperm ..	487·20 grains
Value of gas from 1 ton of coal, in sperm ..	769·19 lb.
Illuminating power of gas in standard candles (per London Argand)	20·30 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·50 per cent.
Carbonic acid (CO_2) in foul gas	3·75 per cent.
Carbon oxide (CO) in foul gas	5·75 per cent.
Sulphur eliminated with volatile products	12·54 lb.

Liquid products—

Tar per ton of coal	15·25 gallons
Ammoniacal liquor per ton of coal ..	36·70 gallons
Strength of ammoniacal liquor	2·50 degs. Twadd.
Hygrometric water per ton of coal ..	21·10 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	12·16 per cent.

Solid products—

Coke per ton of coal	1,214·08 lb.
Carbon in the coke	93·20 per cent.
Ash in the coke	6·80 per cent.
Sulphur in coke per ton of coal	4·70 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	12·83 lb.

While yielding a good average volume of 20·3 candle gas, this coal affords 10·84 cwt. of excellent coke per ton. The coal contains about the average percentage of impurities, but over the average amount of water. Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas and 1,535·5 lb. of sperm value per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 53·19.

Analyst—Geo. R. Hislop, F.C.S., M.S.C.Ind., F.R.S.S.A.
Date of Analysis—February 2, 1906.

Notes.

EDINBURGH.

NIDDRIE AND BENHAR COAL COMPANY LIMITED,

29, Hanover Street, Edinburgh.

Colliery— . . . . Great Seam, ... Pit.
Shipping Port— . . . .
Rail— . . . . Station.
Canal— . . . .

Niddrie Great Seam or No. 1 Cannel Coal.

Class of Coal—Gas.

		Per cent.
Chemical analysis—		
Volatile matters (containing 0·43 of sulphur)		48·02
Coke, consisting of—		
Carbon	45·30	
Sulphur	0·27	
Ash	2·41	
		47·98
Water expelled at 212 degs. Fahr.		4·00
		100·00

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	12,330 cubic feet
Gas from 1 cubic foot of the coal	425·88 cubic feet
Specific gravity of the gas	·568 (air 1·000)
Hydrocarbons absorbed by bromine ..	13·50 per cent.
Durability of 1 cubic foot by 5 in. jet flame	62 min. 30 sec.
Value of 1 cubic foot of gas in sperm ..	778·80 grains
Value of gas from 1 ton of coal in sperm	1,371·80 lb.
Illuminating power of gas in std. candles	32·45 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·33 per cent.
Carbonic acid (CO_2) in foul gas	3·25 per cent.
Carbonic oxide (CO) in foul gas	4·50 per cent.
Sulphur eliminated with volatile products	9·64 lb.
Liquid products—	
Tar per ton of coal	26·50 gallons
Ammoniacal liquor per ton of coal ..	16·80 gallons
Strength of ammoniacal liquor	3·50 degs. Twadd.
Hygrometric water per ton of coal ..	8·96 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	5·46 per cent.

EDINBURGH.

Notes.

Solid products—

Coke per ton of coal	1,074·75 lb.
Carbon in the coke	95·20 per cent.
Ash in the coke	4·80 per cent.
Sulphur in coke per ton of coal	6·04 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)..	13·07 lb.

This is a cannel coal of the first class, as, in addition to yielding a large volume of rich gas, it affords fully 9½ cwt. of first class coke, and contains a moderate amount of both water and sulphur.

Analyst—Geo. R. Hislop, F.C.S., F.R.S.S.A.
Date of Analysis—April 26, 1887.

SHOTTS IRON COMPANY LIMITED,

130, George Street, Edinburgh.

Colliery—LOANHEAD, Great Seam, ... Pit.
Shipping Ports—Leith, Granton.
Rail—North British, Loanhead Station.
Canal—None.

Loanhead Steam Coal.

Class of Coal—Steam.

Chemical analysis—		Per cent.
Volatile matters (containing 0·46 of sulphur)		36·74
Coke, consisting of—		
Carbon	51·02	
Sulphur	0·27	
Ash	4·22	
		55·51
Water expelled at 212 degs. Fahr. ..		7·75
		100·00

Analyst—Geo. R. Hislop, F.C.S., &c.
Date of Analysis—April 9, 1891.

Notes

FIFESHIRE.

BOWHILL COAL COMPANY LIMITED,

Cardenden.

Colliery—Bowhill, Five-feet Seam, Bowhill Pit.
Shipping Ports—Burntisland and Methil.
Rail—North British, Cardenden Station.
Canal— . . . . . .

Bowhill Navigation Steam Coal.

Class of Coal—Steam.

	Per cent.		Per cent.
Carbon	79·10	..	84·07
Hydrogen	5·11	..	5·43
Oxygen	8·32	..	8·84
Nitrogen	1·56	..	1·66
Sulphur	0·85	..	—
Ash	1·15	..	—
Water	3·91	..	—
	100·00	..	100·00

	Per cent.
Fixed carbon	61·95
Volatile matters (other than sulphur and water)	32·14
Ash, sulphur, and water	5·91
	100·00

Specific gravity, 1·288, water at 60 degs. Fahr. being 1·000.
Colour of ash, yellowish; nature of coal, bituminous.
Coke, 63·1 per cent., hard and compact, and well fused.
Total heat units (Favre and Silbermann) 7,773.
Calorific power (Thomson), 7,443 calories.
Evaporative power (Thomson), 13·86 lb. of water per pound of coal.

This coal is of a bituminous nature. The amounts of ash and sulphur are very favourable, and generally speaking it is a good coal of its class, and, considering its bituminous character, the coal will, I think, give excellent results for steam purposes, and it is also of a hard nature, which makes it well suited for transit.

Analyst—Thomas Hughes.

Date of Analysis—November 19, 1904.

FIFESHIRE.

Notes.

DUNDONALD COLLIERIES,

Cardenden.

Colliery—DUNDONALD, Mynheer Seam, No. 1 Pit.
Shipping Ports—Methil, Burntisland.
Rail—North British, Cardenden Station.
Canal—None.

Dundonald Mynheer Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

A sample of this coal, representing the entire product of the seam, gave, on examination, the following results—

The coal is black, possesses moderate to considerable lustre and brown streak. Fracture regular to irregular and partly laminated with deposits of charcoal, a 3 in. band semi-cannel. Cross-fracture angular and resinoid, with considerable deposits of calcium carbonate and ferric bisulphide; moderately cohesive but porous; under distillation it intumesces and agglomerates. Colour of ash, brown; mean specific gravity, 1·223 (water 1·000); weight of 1 cubic foot, 76·43 lb.

		Per cent.
Volatile matters (containing 0·62 of sulphur)		37·96
Coke, consisting of—		
Carbon	49·17	
Sulphur	0·23	
Ash	2·72	
		52·12
Water expelled at 212 degs. Fahr. ..		9·92
		100·00

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar.	11,610 cubic feet
Gas from 1 cubic foot of the coal	397·03 cubic feet
Specific gravity of the gas	·487 (air 1·000)
Hydrocarbons absorbed by bromine ..	5·50 per cent.
Durability of 1 cubic foot by 5 in. jet flame	42 min. 28 sec.
Value of 1 cubic foot of gas in sperm ..	460·80 grains
Value of gas from 1 ton of coal in sperm ..	764·26 lb.
Illuminating power of gas in standard candles (London Argand)	19·20 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·75 per cent.
Carbonic acid (CO_2) in foul gas	3·25 per cent.
Carbonic oxide (CO) in foul gas	6·00 per cent.
Sulphur eliminated with volatile products	16·27 lb.

Notes.

FIFESHIRE.

Dundonald Mynheer Coal—*cont.*

Liquid products—

Tar per ton of coal	14·30 gallons
Ammoniacal liquor per ton of coal ..	39·50 gallons
Strength of ammoniacal liquor	2·50 degs. Twadd.
Hygrometric water per ton of coal ..	22·22 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	12·86 per cent.

Solid products—

Coke per ton of coal	1,177·48 lb.
Carbon in the coke	94·80 per cent.
Ash in the coke	5·20 per cent.
Sulphur in the coke per ton of coal ..	5·01 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	13·02 lb.

This is a good coal for the production of gas and coke, and as such yields a large volume of 19·2-candle gas, and at same time affords 10½ cwt. per ton of first-class coke. The aqueous absorbent capacity of the coal, however, exceeds the average. Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas, and 1,535·5 lb. of sperm value per ton, and having regard also to the value of the secondary products, and the cost of the purification of the gas) this coal is equal to 56·50.

Analyst—Geo. R. Hislop, F.C.S., &c.

Date of Analysis—March 28, 1903.

THE FIFE COAL COMPANY LIMITED,

Leven.

Colliery—KELTY, Dunfermline Splint and Five-feet Seam, Aitken Pit.

Shipping Ports—Burntisland, Methil, Leith, Dundee, Glasgow.

Rail—North British, Kelty Station.

Canal—None.

Aitken Navigation Steam Coal.

Class of Coal—Steam.

	(Dry coal.) Per cent.
Carbon	86·15
Hydrogen	4·87
Oxygen	5·00
Nitrogen	1·34
Sulphur	0·70
Ash	1·94
	100·00

Notes.

FIFESHIRE.

Fixed carbon	70·61
Volatile matters, other than sulphur and water	24·47
Sulphur, ash, and water.. ..	4·92
	100·00

Specific gravity, 1·258, water at 60 degs. Fahr. being 1·000. Colour of ash, buff. Nature of coal, caking. Total heat units (Favre and Silbermann), 8,214. Calorific power (Thompson), 7,649 calories.

This coal resembles some of the more bituminous South Wales coal, but more closely, perhaps, some of the more valuable Monmouthshire coals. Like them, it has a high percentage of carbon and hydrogen, with a moderate but higher percentage of oxygen than is found in the drier South Wales coals. The sulphur is low and favourable.

This coal is of excellent quality, and as a house coal, or for furnace or steam purposes, where a rather bituminous coal free from excess of ash or sulphur is required, it must be very valuable.

Analyst—Thomas Hughes.

Date of Analysis—June 9, 1897.

WALTER HERD AND SONS,

Kirkcaldy.

Colliery—DUNNIKIER, Five-feet Seam, Panny Pits.

Shipping Ports—Methil, Burntisland.

Rail—North British Railway, Sinclairton Station.

Canal—None.

Dunnikier Coking Gas Coal.

Class of Coal—Gas.

A sample of this coal, representing the entire product of the seam, gave on examination the following results:—

The coal is black, possesses high lustre and brown to brownish-black streak, fracture irregular with deposits of charcoal; cross-fracture angular to cubical and resinoid with numerous natural partings containing thin deposits of calcium carbonate and ferric bisulphide; friable but compact or non-porous. Under distillation it intumesces and agglomerates. Colour of ash, brown. Mean specific gravity 1·251 (water 1·000). Weight of 1 cubic foot, 78·20 lb.

		Per cent.
Volatile matters (containing 0·35 of sulphur) ..		32·11
Coke, consisting of—		
Carbon	59·28	
Sulphur	0·19	
Ash	4·90	
		64·37
Water expelled at 212 degs. Fahr.		3·52
		100·00

Notes.

FIFESHIRE.

Dunnikier Coking Gas Coal—*cont.*

Gaseous products—

Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	12,180 cubic feet
Gas from 1 cubic foot of the coal	425·21 cubic feet
Specific gravity of the gas	·482 (air 1·000)
Hydrocarbons absorbed by bromine ..	5·25 per cent.
Durability of 1 cubic foot by 5 in. jet flame	45 min. 8 sec.
Value of 1 cubic foot of gas in sperm ..	481·44 grains
Value of gas from 1 ton of coal in sperm..	837·71 lb.
Illuminating power of gas in standard candles (per London Argand)	20·06 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·25 per cent.
Carbonic acid (CO_2) in foul gas	2·00 per cent.
Carbonic oxide (CO) in foul gas	6·25 per cent.
Sulphur eliminated with volatile products	7·96 lb.

Liquid products—

Tar per ton of coal	14·10 gallons
Ammoniacal liquor per ton of coal ..	13·24 gallons
Strength of ammoniacal liquor	3·00 degs. Twadd.
Hygrometric water per ton of coal ..	7·88 gallons
Aqueous absorbent capacity of coal (determined by complete saturation) ..	5·86 per cent.

Solid products—

Coke per ton of coal	1,441·88 lb.
Carbon in the coke	92·40 per cent.
Ash in the coke	7·60 per cent.
Sulphur in coke per ton of coal	4·13 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)..	12·69 lb.

This is a remarkably good gas and coking coal, yielding as it does a very large volume of 20-candle gas, and at same time affording 12·87 cwt. of first-class coke per ton. The foul gas also contains a minimum percentage of impurities. Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the bases of a production of 13,000 cubic feet of gas, and 1,535·5 lb. of sperm value per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 60·62.

Analyst—Geo. R. Hislop, F.C.S., M.S.C.Ind., F.R.S.S.A.
Date of Analysis—March 13, 1903.

Notes.

FIFESHIRE.

Dunnikier Navigation Steam Coal.

Class of Coal—Steam.

	Per cent.		Per cent., exclusive of Sulphur, Ash, and Water.
Carbon	75·78	..	85·19
Hydrogen	4·96	..	5·57
Oxygen	6·87	..	7·72
Nitrogen	1·35	..	1·52
Sulphur	0·91	..	—
Ash	5·38	..	—
Water	4·75	..	—
	100·00	..	100·00

	Per cent.
Fixed carbon	63·12
Volatile matters (other than sulphur and water)	25·84
Ash, sulphur and water	11·04
	100·00

Specific gravity, 1·293, water at 60 degs. Fahr. being 1·000.

Colour of ash, light brownish: nature of coal, caking.

Coke, 68·50 per cent., small bulk, dull in appearance, but hard and coherent.

Total heat units (Favre and Silvermann), 7,510.

Calorific power (Thompson), 7,233 calories.

Evaporative power in pounds of water per pound of coal (as determined by Thompson's calorimeter), 13·47 lb.

The coal is of a bituminous character. The proportion of sulphur is fairly favourable, but the ash is a little high. Generally speaking, however, it is a very useful coal of its class. Owing to the nature and general character of the coal, the calorific power, as determined by Thompson's calorimeter, is about 1 lb. of water per pound of coal—less than that usually given by the best semi-bituminous steam coals.

Analyst—Thomas Hughes, F.I.C., F.C.S.

Date of Analysis—April 10, 1902.

Notes.

FIFESHIRE.

Colliery—DUNNIKIER, Parrot Seam, Panny and Begg Pits.

Dunnikier Cannel Coal.

Class of Coal—Gas.

		Per cent.
Volatile matters—		
Gas, tar, &c.	32·69	
Sulphur	·08	
Water	4·73	
		37·50
Coke—		
Fixed carbon	57·15	
Sulphur	·05	
Ash	5·30	
		62·50
		100·00

Coke (dry) per ton of coal, 1,400 lb., equal to 12 cwt. 2 qrs.

	Per cent.
Analysis of the coke (dry)—	
Carbonaceous, or combustible matter	91·44
Sulphur	·08
Ash	8·48
	100·00

Practical results—	
Gas per ton of coal at 60 degs. Fahr. and 30 in. bar. pressure	10,550 cubic feet
Illuminating power, by union jet, consuming 5 cubic feet per hour at 5 in. water pressure	23·16 candles
Value of 1 cubic foot in grains of sperm ..	556
Value of 1 ton of coal in pounds of sperm	838
Durability of 1 cubic foot of gas by 5 in. flame	50 minutes
Specific gravity of the gas (air, 1·000) ..	·503

This is a useful cannel coal, giving per ton 10,550 cubic feet of 23-candle gas, and 12½ cwt. of excellent coke.

Analyst—Robert R. Tatlock, F.R.S.E., F.C.S.

Date of Analysis—February 9, 1875.

Notes.

FIFESHIRE.

LOCHGELLY IRON AND COAL COMPANY,

Lochgelly.

Colliery—LOCHGELLY, ... Seam, ... Pit.
Shipping Ports—Burtisland, Methil.
Rail—North British, Lochgelly, Cardenden, and Cowdenbeath Stations.
Canal— . . . .

Lochgelly Steam Coal.

Class of Coal—Steam.

	Per cent.		Cwt.	qr.	lb.
Volatile matters—gas, tar, water, &c. ..	41·87	per ton	8	1	14
Fixed carbon	55·08	,,	11	0	2
Ash	2·75	,,	0	2	5
Sulphur	0·30	,,	0	0	7
	100·00		20	0	0

Coke—57·98 per cent.

Heating powers, or number of pounds of steam produced by 1 lb. of coal	7·71
Weight of coke per ton of coal	11 cwt. 2 qr. 10 lb.
Fixed carbon in coke	94·99 per cent.
Ash in coke	4·74 per cent.
Specific gravity of the coal	1·290
Weight of cubic foot	80·6 lb.

This is a hard clean coal of excellent quality. The fixed carbon and steam-raising power are very high, while both sulphur and ash are low; the latter is of a light grey colour.

Analyst— . . . .
Date of Analysis— . . . .

Lochgelly Navigation Coal.

Class of Coal—Steam.

	Per cent.		Per cent. exclusive of Sulphur, Ash and Water.
Carbon	82·63	..	86·55
Hydrogen	5·05	..	5·29
Oxygen	6·10	..	6·39
Nitrogen	1·69	..	1·77
Sulphur	0·66	..	—
Ash	1·42	..	—
Water	2·45	..	—
	100·00	..	100·00

Notes.

FIFESHIRE.

Lochgelly Navigation Coal—*cont.*	Per cent.
Fixed carbon	72·58
Volatile matter (other than sulphur and water) ..	22·89
Ash, sulphur and water	4·53
	100·00

Specific gravity 1·298, water at 60 degs. Fahr. being 1·000; colour of ash, reddish; nature of coal, caking; coke, 74·0 per cent., moderately fused; small bulk, and dull in appearance; total heat units (Favre and Silbermann), 8,141; calorific power (Thomson), 7,679; evaporative power (Thomson), 14·30 lb. of water per pound of coal.

This coal closely resembles those of Monmouthshire, but the best Monmouthshire coals usually cake more freely. The best Cardiff steam coals contain from 87 to 89 per cent. of carbon, 4 to 5 per cent. of hydrogen, and 2 to 4 per cent. of oxygen. The coke ranges from 83 to 84 to 87 or 88 per cent., and in the drier coals up to 90, or even 91 per cent. The total heat units usually vary from 8,400 to 8,700, and the evaporative power (determined by Thomson's calorimeter) varies from 14·1 to 14·2 to 14·5 or 14·6 lb. of water per pound of coal.

The Monmouthshire coals usually contain less carbon, and a little more hydrogen and oxygen, and the coke ranges from 75 to 85 per cent. Those are merely rough figures, as the coals vary in nature and composition.

Analyst—Thomas Hughes, F.I.C.

Date of Analysis—March 4, 1904.

Lochgelly Cannel Coal.

Class of Coal—Gas.

A sample of this coal, representing the entire product of the seam, gave on examination the following results:—

The coal is black, possesses considerable lustre and brown streak; fracture irregular, undulating, and semi-conchoidal; cross-fracture highly conchoidal to coarse and hackly, with deposits of calcium carbonate and ferric bisulphide; very cohesive and compact; under distillation it does not intumesce; colour of ash, white; thickness of seam, 22 in., and of very uniform density; mean specific gravity, 1·321 (water 1·000); weight of 1 cubic foot, 82·5 lb.

		Per cent.
Volatile matters (containing 0·58 of sulphur)		34·17
Coke, consisting of—		
Carbon	56·49	
Sulphur	0·17	
Ash	5·75	
		62·41
Water expelled at 212 degs. Fahr. ..		3·43
		100·00

Fifeshire.

Notes.

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	10,870 cubic feet
Gas from 1 cubic foot of the coal	400·34 cubic feet
Specific gravity of the gas	·562 (air 1·000)
Hydrocarbons absorbed by bromine ..	8·80 per cent.
Durability of 1 cubic foot by 5 in. jet flame	56 min. 36 sec.
Value of 1 cubic foot of gas in sperm ..	634·32 grains
Value of gas from 1 ton of coal in sperm..	985·00 lb.
Illuminating power of gas in standard candles	26·43 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·50 per cent.
Carbonic acid (CO_2) in foul gas	2·00 per cent.
Carbonic oxide (CO) in foul gas	7·50 per cent.
Sulphur eliminated with volatile products	12·99 lb.
Liquid products—	
Tar per ton of coal	17·20 gallons
Ammoniacal liquor per ton of coal ..	13·86 gallons
Strength of ammoniacal liquor	3·50 degs. Twadd.
Hygrometric water per ton of coal ..	7·66 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	5·25 per cent.
Solid products—	
Coke per ton of coal	1,397·98 lb.
Carbon in the coke	90·80 per cent.
Ash in the coke	9·20 per cent.
Sulphur in coke per ton of coal	3·81 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)..	12·47 lb.

This is a good second-class cannel coal. It is easily distilled, yields a good average volume of 26·43-candle gas, and affords 12·48 cwt. of coke of fair quality per ton. The coal and foul gas at same time contain each a minimum amount of impurities. Compared with Main Lesmahagow cannel coal represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas and 1,535·5 lb. of sperm value per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 69·37.

Analyst—Geo. R. Hislop, F.C.S., M.S.C.Ind., F.R.S.S.A.

Date of Analysis—March 12, 1904.

Notes.

FIFESHIRE.

Lochgelly Duff Coal.

After treatment by patent coal-washer.

Class of Coal— . . . . . .

	Per cent.
Ash	8·10
Sulphur	0·46
Moisture	7·00
Volatile hydrocarbons	36·62
Fixed carbon	47·82
	100·00

Analyst— . . . . .

Date of Analysis— . . . .

HENRY NESS AND CO. LIMITED,

Dunfermline.

Colliery—MUIRBEATH, Three-feet Seam, Muirbeath Pit.
Shipping Port—Burntisland, Methil, Leith, Dundee, Charlestown.
Rail—North British, Dunfermline Station.
Canal— . . . . . .

Muirbeath Cannel Coal.

Class of Coal—Gas.

A sample of this coal, representing the entire product of the seam, gave on examination the following results:—

The coal is brownish black with yellowish brown streak; fracture, rather irregular and coarse, with impressions of stigmaria and finely diffused deposits of bright ferric bisulphide; cross-fracture is angular and curly, to semi-conchoidal, with slight deposits of calcium carbonate; compact and very cohesive; on the fire it intumesces and agglomerates; colour of ash, brown; mean specific gravity, 1·247 (water 1·000); weight of one cubic foot, 77·94 lb.

		Per cent.
Volatile matters (containing 0·46 of sulphur)		47·41
Coke, consisting of—		
Carbon	42·64	
Sulphur	0·18	
Ash	7·27	
		50·09
Water expelled at 212 degs. Fahr. ..		2·50
		100·00

Notes.

Fifeshire.

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar.	13,807 cubic feet
Gas from 1 cubic foot of the coal	480·41 cubic feet
Specific gravity of the gas	·629 (air 1·000)
Hydrocarbons absorbed by bromine ..	13·75 per cent.
Durability of 1 cubic foot by 5 in. jet flame	66 min. 40 sec.
Value of 1 cubic foot of gas in sperm ..	818·40 grains
Value of gas from 1 ton of coal in sperm ..	1,628·52 lb.
Illuminating power of gas in std. candles	34·10 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·25 per cent.
Carbonic acid (CO_2) in foul gas	2·00 per cent.
Carbonic oxide (CO) in foul gas	6·25 per cent.
Sulphur eliminated with volatile products	10·30 lb.
Liquid products—	
Tar per ton of coal	25·10 gallons
Ammoniacal liquor per ton of coal ..	9·40 gallons
Strength of ammoniacal liquor	3·70 degs. Twadd.
Hygrometric water per ton of coal ..	4·59 gallons
Aqueous absorbent capacity of coal (determined by complete saturation) ..	3·70 per cent.
Solid products—	
Coke per ton of coal	1,122·01 lb.
Carbon in the coke	85·50 per cent.
Ash in the coke	14·50 per cent.
Sulphur in coke per ton of coal	4·03 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	11·74 lb.

This is a first-class cannel coal, it is easily distilled, and yields an amount of illuminating matter considerably exceeding that obtained from Main Lesmahagow, and at same time contains a very small percentage of both sulphur and water.

Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas) this coal is equal to 107·91.

Analyst—Geo. R. Hislop, F.C.S., F.I.Inst., F.R.S.S.A.

Date of Analysis—April 20, 1895.

Notes.

Fifeshire.

Muirbeath Cairncubie Splint Coal.

Class of Coal—Gas.

A sample of this coal, representing the entire product of the seam, gave on examination the following results:—

This coal is black and of moderate to considerable lustre and brown streak; fracture, partly laminated and partly irregular; cross-fracture, angular, brighter portion inclines to conchoidal and resinoid, with slight deposits of calcium carbonate in the partings; moderately cohesive, but rather porous; thickness of seam, 42 in.; mean specific gravity, 1·214 (water 1·000); weight of 1 cubic foot, 75·87 lb.

		Per cent.
Volatile matters (containing 0·44 of sulphur)		35·90
Coke, consisting of—		
Carbon	52·92	
Sulphur	0·18	
Ash	1·20	
		54·30
Water expelled at 212 degs. Fahr. ..		9·80
		100·00

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	10,475 cubic feet
Gas from 1 cubic foot of the coal	354·79 cubic feet
Specific gravity of the gas	·558 (air 1·000)
Hydrocarbons absorbed by bromine ..	7·25 per cent.
Durability of 1 cubic foot by 5 in. jet flame	42 min. 48 sec.
Value of 1 cubic foot of gas in sperm ..	511·20 grains
Value of gas from 1 ton of coal in sperm ..	764·97 lb.
Illuminating power of gas in std. candles (per London Argand)	21·30 candles
Sulphuretted hydrogen (H_2S) in foul gas ..	1·20 per cent.
Carbonic acid (CO_2) in foul gas	3·50 per cent.
Carbonic oxide (CO) in foul gas	9·50 per cent.
Sulphur eliminated with volatile products	9·85 lb.
Liquid products—	
Tar per ton of coal	17·45 gallons
Ammoniacal liquor per ton of coal ..	30·60 gallons
Strength of ammoniacal liquor	2·50 degs. Twadd.
Hygrometric water per ton of coal ..	21·95 gallons
Aqueous absorbent capacity of coal (determined by complete saturation) ..	14·46 per cent.

Notes.

FIFESHIRE.

Solid products—

Coke per ton of coal	1,216·32 lb.
Carbon in the coke	97·80 per cent.
Ash in coke	2·20 per cent.
Sulphur in coke per ton of coal	4·03 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	13·43 lb.

This is a good and useful coal for the production of gas, and claims special recommendation on account of the remarkably pure coke that it affords. It possesses a rather large aqueous absorbent capacity. Compared with Main Lesmahagow cannel coal represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 57·19.

Analyst—Geo. R. Hislop, F.C.S., F.I.Inst., F.R.S.S.A.

Date of Analysis—August 24, 1895.

Muirbeath Three-feet Gas Coal.

Class of Coal—Gas.

A sample of this coal, representing the entire product of the seam, gave on examination the following results :—

The coal is black with brown streak, and moderate lustre ; fracture partly inclines to slaty, while cross-fracture is angular, and partly highly resinoid with deposits of calcium carbonate and ferric bisulphide in the natural partings ; moderately cohesive, but very porous ; on the fire it intumesces and agglomerates ; colour of ash, pale brown and flocculent ; mean specific gravity, 1·206 (water 1·000) ; weight of 1 cubic foot, 75·37 lb.

		Per cent.
Volatile matters (containing 0·27 of sulphur)		36·79
Coke, consisting of—		
Carbon	51·77	
Sulphur	0·24	
Ash	2·00	
		54·01
Water expelled at 212 degs. Fahr. ..		9·20
		100·00

Notes.

FIFESHIRE.

Muirbeath Three-feet Gas Coal—*cont.*

Gaseous products—

Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	10,995 cubic feet
Gas from 1 cubic foot of the coal	369·95 cubic feet
Specific gravity of the gas	·534 (air 1·000)
Hydrocarbons absorbed by bromine ..	7·10 per cent.
Durability of 1 cubic foot by 5 in. jet flame	48 min. 8 sec.
Value of 1 cubic foot of gas in sperm ..	559·20 grains
Value of gas from 1 ton of coal in sperm	878·37 lb.
Illuminating power of the gas in standard candles	23·30 candles
Sulphuretted hydrogen (H_2S) in foul gas	0·60 per cent.
Carbonic acid (CO_2) in foul gas	4·10 per cent.
Carbonic oxide (CO) in foul gas	7·00 per cent.
Sulphur eliminated with volatile products	6·07 lb.

Liquid products—

Tar per ton of coal	16·53 gallons
Ammoniacal liquor per ton of coal ..	32·25 gallons
Strength of ammoniacal liquor	2·30 degs. Twadd.
Hygrometric water per ton of coal ..	20·60 gallons
Aqueous absorbent capacity of coal (determined by complete saturation) ..	14·20 per cent.

Solid products—

Coke per ton of coal	1,209·82 lb.
Carbon in the coke	96·30 per cent.
Ash in the coke	3·70 per cent.
Sulphur in the coke per ton of coal ..	5·35 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	13·23 lb.

This is an excellent splint coal. It yields a considerable volume of gas of unusually rich quality for a splint coal, and contains a very small amount of sulphur, but considerably over the average percentage of water. The coke is of first-class quality.

Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 63·10.

Analyst—Geo. R. Hislop, F.C.S., F.I.Inst., F.R.S.S.A.

Date of Analysis—April 24, 1895.

FIFESHIRE.

Notes.

WILSONS AND CLYDE COAL COMPANY LIMITED

75, Bothwell Street, Glasgow.

Colliery—GLENCRAIG, ... Seam, ... Pit.
Shipping Port— . . . .
Rail— . . . . Station.
Canal— . . . .

Glencraig Cannel Coal.

Class of Coal—Gas.

		Per cent.
Volatile matters (containing 0·39 of sulphur)		32·72
Coke, consisting of –		
Carbon	54·38	
Sulphur	0·19	
Ash	7·31	
		61·88
Water expelled at 212 degs. Fahr. ..		5·40
		100·00

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar	10,840 cubic feet
Gas from 1 cubic foot of the coal	375 cubic feet
Specific gravity of the gas	·543 (air 1·000)
Hydrocarbons absorbed by bromine ..	8·50 per cent.
Durability of 1 cubic foot by 5 in. jet flame	50 min. 47 sec.
Value of 1 cubic foot of gas in sperm ..	605 grains
Value of gas from 1 ton of coal in sperm ..	937 lb.
Illuminating power in standard candles ..	25·23 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·00 per cent.
Carbonic acid (CO_2) in foul gas	3·60 per cent.
Carbonic oxide (CO) in foul gas	8·20 per cent.
Sulphur eliminated with volatile products	8·83 lb.
Liquid products—	
Tar per ton of coal	17 gallons
Ammoniacal liquor per ton of coal ..	25 gallons
Strength of ammoniacal liquor	2·80 degs. Twadd.
Hygrometric water per ton of coal ..	14·33 gallons
Aqueous absorbent capacity of coal (determined by complete saturation) ..	9·50 per cent.

Notes.

FIFESHIRE.

Glencraig Cannel Coal—*cont.*

Solid products—

Coke per ton of coal	1,386 lb.
Carbon in the coke	88·20 per cent.
Ash in the coke	11·80 per cent.
Sulphur in coke per ton of coal	4·46 lb.
Heating power of 1 lb. of coke (water from boiling point into steam) ..	12·05 lb.

This is a fairly good cannel coal, giving, as it does, over 10,800 cubic feet of 25-candle gas, while the amounts of water and sulphur are about the average. The coke is also of fairly good quality, although the percentage of ash is a little high.

Analyst—Geo. R. Hislop, F.C.S., &c.

Date of Analysis— . . . . . .

Glencraig Wilson Navigation Steam Coal.

Class of Coal—Steam.

	Dry coal. Per cent.
Carbon	86·64
Hydrogen	4·99
Oxygen	4·06
Nitrogen	1·26
Sulphur	0·84
Ash	2·21
	100·00
Fixed carbon	70·50
Volatile matters (other than sulphur and water)	25·32
Ash, sulphur and water	4·18
	100·00

Specific gravity, 1·285, water at 60 degs Fahr. being 1·000; colour of ash, yellowish; nature of coal, caking; total heat units (Favre and Silbermann), 8,399; calorific power (Thomson) 14·35 lb. of water per pound of coal, equivalent to 7,706 calories.

The character of this coal is somewhat similar to the more bituminous South Wales steam coals, but it resembles some of the best Monmouthshire steam coals still more closely. For house, furnace, or steam purposes this coal is of excellent quality.

This coal is on the British and Dutch Admiralty lists, and is one of the best bunker coals for ocean liners to be had in Scotland,

FIFESHIRE.

Notes.

resembling best Welsh bunker fuel. It is exported to Baltic and Mediterranean ports, where it is used largely by the principal Continental railway companies.

Analyst—Thos. Hughes, F.I.C. (?)
Date of Analysis— . . . .

Glencraig Lochgelly Steam Coal.

Class of Coal—Steam and House.

		Per cent.
Volatile matter—		
Gas, tar, &c.	36·49	
Sulphur	0·24	
Water	6·12	
		42·85
Coke—		
Fixed carbon	53·37	
Sulphur	0·33	
Ash	3·45	
		57·15
		100·00

Heating power, practical, Playfair's formula (water at 212 degs. Fahr. evaporated by 1 lb. of coal)	8·06 lb.
Specific gravity	1·31
Weight of 1 cubic foot	81·87 lb.

This is an excellent coal in every respect. It is well adapted for steam-raising, and as it contains but little sulphur, and is very free from ash, it would be a very clean coal to handle and work. A steam coal producing less clinker could scarcely be found, and altogether it would give good results in practice. For household purposes this coal could hardly be surpassed.

This is known as a Fife first-class coal, and although it has not long been on the market, it already commands a good sale for ports in the Baltic and Mediterranean, having yielded splendid results.

Analyst— . . . .
Date of Analysis— . . . .

Notes.

HADDINGTON.

FORTH COLLIERIES (1902) LIMITED,

Preston Links, Prestonpans.

Colliery—PRESTON LINKS, ... Seam, Crown Pit.
Shipping Ports—Leith, Granton.
Rail—North British, Prestonpans Station.
Canal—None.

Forth Crown Hartley Jewel Coal.

Class of Coal—Gas.

A sample of this coal, representing the entire product of the seam, gave on examination the following results :—

The coal possesses considerable lustre and brownish-black streak; fracture rather intermittent, with slight deposits of charcoal; cross-fracture angular, resinoid, and in part cubical with fine scaly deposits of calcium carbonate; compact, but rather friable; under distillation it intumesces and agglomerates; colour of ash, pale brown; thickness of seam, 51 in. and very uniform in stratification and density, mean specific gravity being 1·251 (water, 1·000); weight of 1 cubic foot, 78·37 lb.

		Per cent.
Volatile matters (containing 0·53 of sulphur)		31·20
Coke, consisting of—		
Carbon	58·56	
Sulphur	0·18	
Ash	5·78	
		64·52
Water expelled at 212 degs. Fahr. ..		4·28
		100·00

Gaseous products—

Gas per ton of coal at 60 degs. Fahr., and 30 in. bar	11,325 cubic feet
Gas from 1 cubic foot of the coal	396·22 cubic feet
Specific gravity of the gas	·483 (air 1·000)
Hydrocarbons absorbed by bromine ..	4·85 per cent.
Durability of 1 cubic foot by 5 in. jet flame	43 min. 28 sec.
Value of 1 cubic foot of gas in sperm ..	465·60 grains
Value of gas from 1 ton of coal in sperm ..	753·27 lb.
Illuminating power of gas in standard candles (per London Argand)	19·40 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·50 per cent.
Carbonic acid (CO_2) in foul gas	2·25 per cent.
Carbonic oxide (CO) in foul gas	7·25 per cent.
Sulphur eliminated with volatile products	11·87 lb.

Notes.

Haddington.

Liquid products—	
Tar per ton of coal	12·58 gallons
Ammoniacal liquor, per ton of coal ..	17·33 gallons
Strength of ammoniacal liquor	2·75 degs. Twadd.
Hygrometric water per ton of coal ..	9·58 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	6·50 per cent.
Solid products—	
Coke per ton of coal	1,445·24 lb.
Carbon in the coke	91·05 per cent.
Ash in the coke	8·95 per cent.
Sulphur in coke per ton of coal	4·03 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	12·51 lb.

This is an excellent gas and coking coal, and as such it yields of the former a considerable volume of 19⅓-candle power, and of the latter nearly 13 cwt., of good quality per ton. The impurities in the foul gas are at same time very moderate in amount. The coal would prove a useful one also for steam raising and general heating purposes.

Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas and 1·535·5 lb. of sperm value per ton, and having regard also to the value of the secondary products, and the cost of the purification of the gas, this coal is equal to 54·05.

Analyst—Geo. R. Hislop, F.C.S., M.S.C.Ind., F.R.S.S.A.
Date of Analysis—March 23, 1905.

Forth Crown Hartley Coal.

Class of Coal—Steam.

		Per cent.
Proximate analysis—		
Volatile matters—		
Gas, tar, &c.	32·84	
Sulphur	0·20	
Water at 212 degs. Fahr. ..	9·98	
		43·02
Coke—		
Fixed carbon	52·13	
Sulphur	0·20	
Ash	4·65	
		56·98
		100·00

Notes.

HADDINGTON.

Forth Crown Hartley Coal—*cont.*

Specific gravity of the coal	1·29
Weight of 1 cubic foot	80 lb.
Coke per ton of coal	11 cwt. 1 qr. 16 lb.
Space occupied for stowage per ton of coal	42 cubic feet

Analysis of the coke (dry)—	Per cent.
Carbonaceous or combustible matter ..	91·49
Sulphur	0·35
Ash	8·16
	100·00

Ultimate analysis of the coal—	
Carbon	69·12
Hydrogen	4·53
Oxygen	9·97
Nitrogen	1·35
Sulphur	0·40
Ash	4·65
Water	9·98
	100·00

Calories or heat units Centigrade contained in the coal	6,719 calories
Heating power (theoretical) in weight of water at 212 degs. Fahr. converted into steam by 1 lb. of the coal..	12·44 lb.

This coal contains very little ash or sulphur, and is suitable for the rapid generation of steam in boilers.

Analyst—John Clark, Ph.D.

Date of Analysis—May 23, 1905.

Notes.

LANARK.

ROBT. ADDIE AND SONS' COLLIERIES LIMITED,

127, St. Vincent Street, Glasgow.

Colliery—VIEWPARK, Splint Seam, ... Pit.
Shipping Ports—All Scotch Ports.
Rail—Caledonian and North British, Uddingston Station.
Canal—None.

Splint Coal.

Class of Coal—Gas.

		Per cent.
Volatile matter—		
Gas, tar, &c.	37·61	
Sulphur	0·70	
Water	6·74	
		45·05
Coke—		
Fixed carbon	49·54	
Sulphur	0·86	
Ash	4·55	
		54·95
		100·00

Heating power, practical, pounds of water at 212 degs. Fahr. evaporated by 1 lb. coal) ..	7·60 lb.
Specific gravity	1·30
Weight of 1 cubic foot	81·25 lb.

Analysts—R. R. Tatlock and Thomson.
Date of Analysis—August 10, 1903.

CADZOW COAL COMPANY LIMITED,

10, Bothwell Street, Glasgow.

Colliery—CADZOW, Hamilton, Lanarkshire, ... Seam, Nos. 1, 2 and 3 Pits.
Shipping Ports—Glasgow, Grangemouth, Bo'ness, Granton, Ardrossan, Greenock.
Rail—Caledonian, Cadzow Branch.
Canal—None.

Cadzow Ell Coal.

Class of Coal—Steam and House.

The sample measured 5 ft. 6 in. in height, being an entire section of the working.

Notes.

LANARK.

Cadzow Ell Coal—*cont.*

		Per cent.
Volatile matters—		
Gas, tar, &c.	34·03	
Sulphur	0·04	
Water at 212 degs. Fahr.	12·05	
		46·12
Coke—		
Fixed carbon	52·90	
Sulphur	0·03	
Ash	0·95	
		53·88
		100·00

Coke (dry) per ton of coal, 1,205 lb., or .. 10 cwt. 3 qr. 1 lb.

	Per cent.
Analysis of the coke (dry)—	
Carbonaceous or combustible matter ..	98·18
Sulphur	0·06
Ash	1·76
	100·00

Specific gravity of the coal	1·250
Weight of a cubic foot	$77\frac{3}{4}$ lb.
Space required for storage, per ton	43 cubic feet
Heating or evaporating power (practical) or pounds of water at 212 degs. converted into steam by the combustion of 1 lb. of coal ..	7·73 lb.

This coal possesses in an eminent degree the qualities for which the Ell coal, in the district where the Cadzow Colliery is situated, has long been famous. It is a household coal of the finest quality, burning with a bright voluminous flame, and giving great heat. It contains little more than a trace of sulphur, and of the many hundreds of coal samples I have tested I have not hitherto had one with so small a proportion of ash as the Cadzow coal. As a steam coal it is of excellent quality for general use. It is also well adapted for shipping to foreign ports, as, from the small proportion of sulphur it contains, it will not be liable to undergo spontaneous combustion, and it possesses sufficient firmness to prevent it from being broken up in course of transit.

Analyst—William Wallace, F.R.S.E., F.C.S., F.I.C.
Date of Analysis—March 15, 1878.

Notes.

LANARK.

Cadzow "Oak Coal."

Class of Coal—House.

		Per cent.
Volatile matters—		
Gas, tar, &c.	34·20	
Sulphur	0·22	
Water at 212 degs. Fahr. ..	9·34	
		43·76
Coke—		
Fixed carbon	51·38	
Sulphur	0·28	
Ash	4·58	
		56·24
		100·00

Coke (dry) per ton of coal, 1,260 lb., or ..	11 cwt. 1 qr. 0 lb.
Analysis of the coke (dry)—	Per cent.
Carbonaceous or combustible matter ..	91·35
Sulphur	0·50
Ash	8·15
	100·00
Specific gravity of the coal	1·282
Weight of a cubic foot	80 lb.
Practical results—	
Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	9,815 cubic feet
Illuminating power in standard sperm candles by union jet consuming 5 cubic feet per hour at 0·5 in. pressure.. ..	14·55 candles
Value of 1 cubic foot of gas in sperm ..	349 grains
Equivalent of a ton of coal in sperm ..	489 lb.
Durability of 1 cubic foot of gas by 5 in. flame	43 min. 0 sec.
Specific gravity of the gas (air=1·000) ..	·415

The sample consisted of a truckload weighing 6 tons 4 cwt., of which 4 tons 4 cwt. were used in the trial. Sugg's London Argand gave 19·29 candles, equal to 463 grains of sperm per cubic foot, and to 649 lb. of sperm per ton of coal.

Tar, 15 gallons per ton; liquor, 35 gallons of 4½ degs. Twaddell, and 6·8 oz. per gallon. This is equal to 20½ lb. sulphate of ammonia per ton of coal. The nitrogen is 1·52 per cent., equal to 160 lb. sulphate of ammonia per ton, so that not much more than one-eighth of the nitrogen is obtained as ammonia.

Analyst—William Wallace, F.R.S.E., F.C.S., F.I.C.

Date of Analysis—December 3, 1884.

Notes.

LANARK.

Cadzow Cannel Coal.

Class of Coal—Gas.

A sample truckload of this coal, representing the entire product of the seam, gave on examination the following results:—

Colour black, with moderate lustre and brown streak; fracture rather irregular and undulating; cross-fracture inclining to conchoidal, with deposits of calcium carbonate and ferric bisulphide in the natural partings; moderately cohesive, but rather porous; on the fire it decrepitates and flies partially and slightly intumesces; colour of ash, brownish-white; thickness of seam, 9 in. of cannel with 1½ to 2 inches of adhering splint coal; mean specific gravity, 1·255 (water 1·000); weight of 1 cubic foot, 78·44 lb.

		Per cent.
Volatile matters (containing 0·53 of sulphur)		36·75
Coke, consisting of—		
Carbon	51·84	
Sulphur	0·26	
Ash	4·05	
		56·15
Water expelled at 212 degs. Fahr. ..		7·10
		100·00

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	10,860 cubic feet
Gas from 1 cubic foot of the coal	380·29 cubic feet
Specific gravity of the gas	·532 (air 1·000)
Hydrocarbons absorbed by bromine ..	8·20 per cent.
Durability of 1 cubic foot by 5 in. jet flame	53 min. 8 sec.
Value of 1 cubic foot of gas in sperm ..	612·72 grains
Value of gas from 1 ton of coal in sperm	950·59 lb.
Illuminating power of gas in standard candles	25·53 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·50 per cent.
Carbonic acid (CO_2) in foul gas	2·70 per cent.
Carbonic oxide (CO) in foul gas	7·30 per cent.
Sulphur eliminated with volatile products	11·86 lb.
Liquid products—	
Tar per ton of coal	17·50 gallons
Ammoniacal liquor per ton of coal ..	28·50 gallons
Strength of ammoniacal liquor	2·40 degs. Twadd.
Hygrometric water per ton of coal ..	15·90 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	11·04 per cent.

LANARK.

Notes.

Solid products—

Coke per ton of coal	1,257·76 lb.
Carbon in the coke	92·80 per cent.
Ash in the coke	7·20 per cent.
Sulphur in coke per ton of coal	5·83 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	12·75 lb.

This is an excellent coal of its class, alike for the production of both gas and coke, as in quality it is not excelled by any other coal from the well-known Lanarkshire splint seam to which it belongs. Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products, and the cost of the purification of the gas), this coal is equal to 67·21.

Analyst—Geo. R. Hislop, F.C.S., F.R.S.S.A.
Date of Analysis—October 10, 1891.

Cadzow Splint Coal.

Class of Coal—Gas, Furnace, and Steam.

A sample of this coal, representing the entire product of the seam, gave on examination the following results :—

The coal is black to brownish black, possesses moderate lustre and brown streak; fracture, slaty and coarse, with slight deposits of charcoal; cross-fracture, angular and coarse, interlaminated with bituminous coal; traces only of calcium carbonate and ferric bisulphide; moderately cohesive and porous; under distillation it partly intumesces and agglomerates, colour of ash, pale brown; thickness of seam, 23 in. and of very uniform density; mean specific gravity being 1·213 (water 1·000); weight of 1 cubic foot, 75·81 lb.

		Per cent.
Volatile matters (containing 0·41 of sulphur)		35·92
Coke, consisting of—		
Carbon	52·26	
Sulphur	0·21	
Ash	4·09	
		56·56
Water expelled at 212 degs. Fahr... ..		7·52
		100·00

Notes.

LANARK.

Cadzow Splint Coal—*cont.*

Gaseous products—

Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	10,875 cubic feet
Gas from 1 cubic foot of the coal	368·05 cubic feet
Specific gravity of the gas	·525 (air 1·000)
Hydrocarbons absorbed by bromine ..	6·80 per cent.
Durability of 1 cubic foot by 5 in. jet flame	48 min. 3 sec.
Value of 1 cubic foot of gas in sperm ..	540·00 grains
Value of gas from 1 ton of coal in sperm ..	838·92 lb.
Illuminating power of gas in standard candles (per London Argand)	22·50 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·00 per cent.
Carbonic acid (CO_2) in foul gas	3·25 per cent.
Carbon oxide (CO) in foul gas	8·00 per cent.
Sulphur eliminated with volatile products	9·18 lb.

Liquid products—

Tar per ton of coal	16·20 gallons
Ammoniacal liquor per ton of coal ..	28·60 gallons
Strength of ammoniacal liquor	3·33 degs. Twadd.
Hygrometric water per ton of coal ..	16·84 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	10·30 per cent.

Solid products—

Coke per ton of coal	1,266·94 lb.
Carbon in the coke	92·60 per cent.
Ash in the coke	7·40 per cent.
Sulphur in coke per ton of coal	4·70 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	12·72 lb.

This is one of the best coals of its class for the manufacture of gas and the production of coke, since of the former it yields a considerable volume of high quality and of the latter 11·31 cwt. of excellent quality per ton. The coal contains a very moderate amount of sulphur, and about the average percentage of water. Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas and 1,535·5 lb. of sperm value per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas) this coal is equal to 60·91.

Analyst—Geo. R. Hislop, F.C.S., M.S.C.Ind., F.R.S.S.A.

Date of Analysis—March 1, 1901.

Notes.

LANARK.

Cadzow Hartley Splint Coal.

Class of Coal—Gas.

A sample of this coal, representing the entire product of the seam, gave on examination the following results:—

The coal possesses moderate lustre and brownish-black streak; fracture slaty and in part glacy, with some deposits of charcoal; cross-fracture, angular, with laminated bituminous coal of cubical fracture and resinoid, with some deposits of calcium carbonate and traces only of ferric bisulphide, massive and rather cohesive; under distillation it partly intumesces and agglomerates; colour of ash, brownish-grey; thickness of seam, 20 in.; mean specific gravity, 1·202 (water 1·000); weight of 1 cubic foot, 75·1 lb.

		Per cent.
Volatile matters (containing 0·54 of sulphur)		35·25
Coke, consisting of—		
Carbon	52·31	
Sulphur	0·17	
Ash	5·07	
		57·55
Water expelled at 212 degs. Fahr... ..		7·20
		100·00

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	11,300 cubic feet
Gas from 1 cubic foot of the coal	378·85 cubic feet
Specific gravity of the gas	·496 (air 1·000)
Hydrocarbons absorbed by bromine ..	5·20 per cent.
Durability of 1 cubic foot by 5 in. jet flame	45 min. 48 sec.
Value of 1 cubic foot of gas in sperm ..	499·20 grains
Value of gas from 1 ton of coal in sperm	805·85 lb.
Illuminating power of gas in standard candles (per London Argand)	20·80 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·50 per cent.
Carbonic acid (CO_2) in foul gas	2·50 per cent.
Carbonic oxide (CO) in foul gas	5·50 per cent.
Sulphur eliminated with volatile products	12·10 lb.
Liquid products—	
Tar per ton of coal	17·30 gallons
Ammoniacal liquor per ton of coal ..	27·30 gallons
Strength of ammoniacal liquor	2·50 degs. Twadd.
Hygrometric water per ton of coal ..	16·12 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	10·40 per cent.

Notes.

LANARK.

Cadzow Hartley Splint Coal—*cont.*

Solid products—

Coke per ton of coal	1,289·12 lb.
Carbon in the coke	91·20 per cent.
Ash in the coke	8·80 per cent.
Sulphur in coke per ton of coal	3·80 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	12·53 lb.

This is a very good gas and coking coal, yielding as it does a considerable volume of 20·8-candle gas, and affording 11½ cwt. of coke of good quality per ton. Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas, and 1,535·5 lb. of sperm value per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 58·39.

Analyst—Geo. R. Hislop, F.C.S., M.S.C.Ind., F.R.S.S.A.
Date of Analysis—June 30, 1905.

Best House Coal.

Class of Coal—House.

	Per cent.
Moisture	9·45
Volatile combustible matter ..	29·67
Carbon	57·70
Ash	3·18
	100·00
Coke	60·80
Sulphur	0·52
Calorific power	7,820 calories
Water evaporated from and at 212 degs. Fahr. by 1 lb. of coal	14·56 lb.
Practical heating power, about	7·28 lb.

Analyst—Douglas A. MacCullum, F.C.S.
Date of Analysis—April 27, 1905.

LANARK.

Notes.

CAPRINGTON AND AUCHLOCHAN COLLIERIES,

Coalburn, Lesmahagow.

Colliery—AUCHLOCHAN, Nine-foot Seam, Nos. 6, 7, 9 and 10 Pits.
Shipping Ports—Grangemouth, Glasgow.
Rail—Caledonian, Coalburn Station.
Canal—None.

Auchlochan Splint Coal.

Class of Coal—Gas, Steam, Manufacturing.

A sample of this coal, representing the entire product of the seam, gave on examination the following results :—

Colour, black, and from dull to moderate lustre; fracture, partly defined by deposits of charcoal; cross-fracture, angular and partly cubical, with numerous alternated laminations of splint and free coal; moderately friable, but rather porous; on the fire it intumesces and agglomerates; colour of ash, brownish grey; thickness of seam 26 in., of which 11 in. are hard splint and 15 in. semi-splint and free coal; mean specific gravity, 1·250 (water 1·000); weight of 1 cubic foot, 78·12 lb.

		Per cent.
Volatile matters (containing 0·51 of sulphur)		36·84
Coke consisting of—		
Carbon	51·77	
Sulphur	0·29	
Ash	2·40	
		54·46
Water expelled at 212 degs. Fahr. ..		8·70
		100·00

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar.	10,720 cubic feet
Gas from 1 cubic foot of the coal	374·31 cubic feet
Specific gravity of the gas	·512 (air 1·000)
Hydrocarbons absorbed by bromine ..	6·5 per cent.
Durability of 1 cubic foot by 5 in. jet flame	47 min. 28 sec.
Value of 1 cubic foot of gas in sperm ..	534·24 grains
Value of gas from 1 ton of coal in sperm ..	818·15 lb.
Illuminating power of gas in standard candles	22·26 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·50 per cent.
Carbonic acid (CO_2) in foul gas	3·10 per cent.
Carbonic oxide (CO) in foul gas	5·20 per cent.
Sulphur eliminated with volatile products	13·72 lb.

Notes.

Lanark.

Auchlochan Splint Coal—*cont.*

Liquid products—

Tar per ton of coal	19·20 gallons
Ammoniacal liquor per ton of coal.. ..	31·60 gallons
Strength of ammoniacal liquor	2·30 degs. Twadd.
Hygrometric water per ton of coal ..	19·48 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	12·10 per cent.

Solid products—

Coke per ton of coal	1,212·73 lb.
Carbon in the coke	95·60 per cent.
Ash in the coke	4·40 per cent.
Sulphur in coke per ton of coal	6·44 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)..	13·13 lb.

While yielding a good average volume of 22¼-candle gas, this splint coal affords 10·82 cwt. of first-class coke. It contains about the average percentage of sulphur, but rather more than the average amount of water. Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 60·25.

Analyst—Geo. R. Hislop.

Date of Analysis—August 8, 1890.

Colliery—AUCHLOCHAN, Six-foot Seam, Nos. 1 and 7 Pits.

Auchlochan Six-feet Splint Coal.

Class of Coal—Gas, Steam, Manufacturing.

A sample of this coal, representing the entire product of the seam, gave on examination the following results:—Colour, dullish black; fracture generally irregular, partly defined by deposits of vegetable charcoal; cross-fracture angular to cubical, partly exhibiting well-defined and alternating laminations of dull black and bright coal, and partly hard and more uniform structure; moderately friable, but rather porous; on the fire it intumesces and agglomerates; colour of ash, pale brown, thickness of seam, 6 ft.; mean specific gravity, 1·299 (water, 1·000); weight of 1 cubic foot, 81·18 lb.

		Per cent.
Volatile matters (containing 0·48 of sulphur)		37·14
Coke, consisting of—		
Carbon	49·96	
Sulphur	0·34	
Ash	4·26	
		54·56
Water expelled at 212 degs. Fahr. ..		8·30
		100·00

Notes.

LANARK.

Gaseous products—

Gas per ton of coal at 60 degs. Fahr., and 30 in. bar.	10,580 cubic feet
Gas from 1 cubic foot of the coal	382·53 cubic feet
Specific gravity of the gas	·508 (air 1·000)
Hydrocarbons absorbed by bromine ..	6·66 per cent.
Durability of 1 cubic foot by 5 in. jet flame	47 min. 36 sec.
Value of 1 cubic foot of gas in sperm ..	532·32 grains
Value of gas from 1 ton of coal in sperm ..	804·56 lb.
Illuminating power of gas in standard candles	22·18 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·50 per cent.
Carbonic acid (CO_2) in foul gas	3·00 per cent.
Carbonic oxide (CO) in foul gas	4·50 per cent.
Sulphur eliminated with volatile products	10·75 lb.

Liquid products—

Tar per ton of coal	18·27 gallons
Ammoniacal liquor per ton of coal ..	32·16 gallons
Strength of ammoniacal liquor	2·50 degs. Twadd.
Hygrometric water per ton of coal	18·59 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	12·30 per cent.

Solid products—

Coke per ton of coal	1,222·14 lb.
Carbon in the coke	92·20 per cent.
Ash in the coke	7·80 per cent.
Sulphur in coke per ton of coal	7·61 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	12·66 lb.

This is a good splint coal for the production of both gas and coke. It contains a moderate amount of sulphur, but rather over the average percentage of water. Compared with Main Lesmahagow cannel coal represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 57·66.

Analyst—Geo. R. Hislop.

Date of Analysis—January 10, 1891.

Notes.

Lanark.

Colliery—Auchlochan, Six-foot Seam, No. 7 Pit.

Auchlochan Brown Splint Coal.

Class of Coal—Gas, Steam.

A sample of this coal, representing the entire product of the seam, gave on examination the following results :—

Colour, dull brown to brownish black; fracture, generally slaty, and in part contains thin deposits of vegetable charcoal; cross-fracture, angular and coarse, with slight deposits of calcium carbonate; moderately cohesive and compact; on the fire it intumesces and agglomerates; colour of ash, brownish grey; thickness of seam, 9 in.; mean specific gravity, 1·248 (water 1·000); weight of 1 cubic foot, 78 lb.

		Per cent.
Volatile matters (containing 0·56 of sulphur)		38·88
Coke, consisting of—		
Carbon	48·55	
Sulphur	0·35	
Ash	5·32	
		54·22
Water expelled at 212 degs. Fahr... ..		6·90
		100·00

Gaseous products—

Gas per ton of coal at 60 degs. Fahr., and 30 in. bar.	10,770 cubic feet
Gas from 1 cubic foot of the coal	375·02 cubic feet
Specific gravity of the gas	·525 (air 1·000)
Hydrocarbons absorbed by bromine ..	8·20 per cent.
Durability of 1 cubic foot by 5 in. jet flame	50 min. 28 sec.
Value of 1 cubic foot of gas in sperm ..	576·96 grains
Value of gas from 1 ton of coal in sperm ..	887·69 lb.
Illuminating power of gas in standard candles	24·04 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·75 per cent.
Carbonic acid (CO_2) in foul gas	3·00 per cent.
Carbonic oxide (CO) in foul gas	5·25 per cent.
Sulphur eliminated with volatile products	12·54 lb.

Liquid products—

Tar per ton of coal	18·72 gallons
Ammoniacal liquor per ton of coal ..	28·10 gallons
Strength of ammoniacal liquor	2·50 degs. Twadd.
Hygrometric water per ton of coal ..	15·45 gallons
Aqueous absorbent capacity of coal (determined by complete saturation) ..	11·20 per cent.

LANARK.

Notes.

Solid products—

Coke per ton of coal	1,214·52 lb.
Carbon in the coke	90·20 per cent.
Ash in the coke	9·80 per cent.
Sulphur in coke per ton of coal	7·84 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	12·39 lb.

This is one of the best gas-yielding splint coals that I have examined. It at same time affords an excellent hard and spongy coke. The amounts of water and sulphur in the coal are, however, slightly over the average. Compared with Main Lesmahagow cannel coal represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas, and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products, and the cost of the purification of the gas, this coal is equal to 61·58.

Analyst—Geo. R. Hislop.
Date of Analysis—January 7, 1891.

Colliery—AUCHLOCHAN, Steam Coal Seam, No. 6 Pit.

Auchlochan Steam Coal.

Class of Coal—Steam.

A sample of this coal, representing the product of the seam, gave on examination the following results:—

The coal possesses moderate to considerable lustre, is partly uniform in stratification and partly alternated by laminæ of dull black and bright coal; contains slight deposits of vegetable charcoal, and is moderately cohesive and porous; on the fire it intumesces and agglomerates; mean specific gravity, 1·284 (water, 1·000); weight of 1 cubic foot, 80·2 lb.

Proximate analysis.—The coal when heated yields—

	Per cent.	Lb. per ton.
Volatile combustible matter ..	31·56	706·94
Fixed carbon	56·68	1,269·63
Ash	4·04	90·50
Sulphur	0·22	4·93
Water	7·50	168·00
	100·00	2,240·00
Coke per ton of coal	60·82	1,362·36

Notes.

LANARK.

Auchlochan Steam Coal—*cont.*

Ultimate analysis—Constituents of the coal—

	Per cent.
Carbon	75·34
Hydrogen	5·38
Nitrogen	1·36
Oxygen	6·16
Sulphur	0·22
Ash	4·04
Hygroscopic water	7·50
	100·00

Calorific or heat-producing power of the coal as determined by the calorimeter—1 lb. of the coal by perfect combustion evolves sufficient heat to raise 13·690 lb. of water 1 deg. Fahr. in temperature, being equal to 76·06 lb. of water from 32 degs. to 212 degs. Fahr., or to 91·26 lb. of water from 62 degs. to 212 degs. Fahr., or to 12·26 lb. of water from 62 degs. to 212 degs. Fahr., thence into steam, or to 14·17 lb. of water from 212 degs. Fahr. into steam.

The foregoing results prove this coal to be well adapted for the production of steam. It contains a considerable proportion of the heat-generating elements, carbon and hydrogen, with a small percentage of ash, and claims special recommendation on account of the exceptionally small quantity of sulphur it contains. By a practical test in a steam boiler furnace, under a moderate to a vigorous draught, the coal produced an intense and long-sustained heat, leaving a pale brown ash.

Analyst—George R. Hislop.
Date of Analysis—February 4, 1891.

Colliery—AUCHLOCHAN, Smithy Coal Seam, No. 6 Pit.

Auchlochan Smithy Coal.

Class of Coal—Gas, Steam, Manufacturing.

A sample of this coal, representing the product of the seam, gave on examination the following results:—

The coal is black and possesses moderate to considerable lustre; the fracture is partly semi-cubical and partly uniform in stratification, exhibiting alternate laminæ of dull black and bright coal; moderately cohesive and porous; on the fire it intumesces and agglomerates; colour of ash, pale brown; mean specific gravity, 1·284 (water 1·000); weight of 1 cubic foot, 80·25 lb.

Notes.

LANARK.

Proximate analysis—

	Per cent.
Combustible matters	88·24
Ash	4·04
Sulphur	0·22
Water	7·50
	100·00
Coke per ton of the coal	60·82

Ultimate analysis—Constituents of the coal—

	Per cent.
Carbon	73·34
Hydrogen	5·38
Nitrogen	1·36
Oxygen	6·16
Sulphur	0·22
Ash	4·04
Hygroscopic water	7·50
	100·00

While the foregoing results prove this to be a coal of high heating power, it possesses also all the other essential characteristics of a first-class smithy coal, and amongst these an exceedingly small percentage of sulphur, and the property of intumescence and agglomeration when heated.

Analyst—Geo. R. Hislop.

Date of Analysis—February 7, 1891.

Colliery—AUCHLOCHAN, Six-foot Seam, Nos. 7, 9 and 10 Pits.

Auchlochan Lesmahagow Six-foot Cannel Coal.

Class of Coal—Gas.

A sample of this coal, representing the entire product of the seam, gave on examination the following results:—Colour, brownish-black, with moderate lustre and brown streak; fracture, rather coarse and irregular, with impressions of stigmaria; cross-fracture, semi-conchoidal and angular, exhibiting laminæ of bituminous coal and slight deposits of ferric bisulphide in the natural partings; compact and cohesive; on the fire it partially and slightly intumesces; colour of ash, pale pinkish brown; thickness of seam, 5½ to 6 in. and well defined; mean specific gravity, 1·260 (water, 1·000); weight of 1 cubic foot, 78·75 lb.

		Per cent.
Volatile matters (containing 0·57 of sulphur)		43·57
Coke, consisting of—		
Carbon	36·87	
Sulphur	0·24	
Ash	16·22	
		53·33
Water expelled at 212 degs. Fahr. ..		3·10
		100·00

Notes.

LANARK.

Auchlochan Lesmahagow Six-foot Cannel Coal—*cont.*

Gaseous products—

Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	12,716 cubic feet
Gas from 1 cubic foot of the coal	447·04 cubic feet
Specific gravity of the gas	·578 (air 1·000)
Hydrocarbons absorbed by bromine ..	13·10 per cent.
Durability of 1 cubic foot by 5 in. gas flame	62 min. 18 sec.
Value of 1 cubic foot of gas in sperm ..	778·32 grains
Value of gas from 1 ton of coal in sperm ..	1,413·87 lb.
Illuminating power of gas in standard candles	32·43 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·75 per cent.
Carbonic acid (CO_2) in foul gas	2·75 per cent.
Carbonic oxide (CO) in foul gas	5·50 per cent.
Sulphur eliminated with volatile products	12·77 lb.

Liquid products—

Tar per ton of coal	23·75 gallons
Ammoniacal liquor per ton of coal ..	12·80 gallons
Strength of ammoniacal liquor	2·50 degs. Twadd
Hygrometric water per ton of coal ..	6·94 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	4·00 per cent.

Solid products—

Coke per ton of coal	1,194·59 lb.
Carbon in the coke	69·60 per cent.
Ash in the coke	30·40 per cent.
Sulphur in coke, per ton of coal	5·37 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	9·53 lb.

This coal yields a large amount of illuminating matter per ton, and contains a small percentage of water, with about the average amount of sulphur. The coal, however, is of little value as a fuel. Compared with Main Lesmahagow cannel coal represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 86·40.

Analyst—Geo. R. Hislop, F.C.S., &c.

Date of Analysis—August 28, 1890.

LANARK.

Notes.

THE CHAPEL COAL COMPANY LIMITED,

Morningside, Newmains.

Collieries—CHAPEL and WATSTONFOOT, Drumgray Seam, Chapel Pit.
Shipping Ports—Glasgow, Grangemouth, Bo'ness, Leith.
Rail—Caledonian and North British, Morningside Station.
Canal—None.

Chapel and Watstonfoot Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

		Per cent.
Volatile matters—		
Gas, tar, &c.	34·98	
Sulphur	0·25	
Water at 212 degs. Fahr. ..	10·86	
		46·09
Coke—		
Fixed carbon	52·21	
Sulphur	0·26	
Ash	1·44	
		53·91
		100·00

Coke per ton of coal	10 cwt. 3 qr. 3 lb.
Specific gravity of the coal	1·273
Weight of 1 cubic foot	$79\frac{1}{2}$ lb.
Heating power (practical) in pounds of boiling water converted into steam by 1 lb. of the coal	7·87 lb.

Analysis of the coke (dry)—	Per cent.
Carbonaceous or combustible matter ..	96·85
Sulphur	0·48
Ash	2·67
	100·00

Analyst—John Clark.

Date of Analysis—July 4, 1890.

Notes.

LANARK.

Collieries—CHAPEL and WATSTONFOOT, Drumgray and Kiltongue Seams, Chapel Pit.

Chapel Drumgray Coal.

Class of Coal—Gas.

	Per cent.
Volatile matters, tar, &c... ..	34·39
Coke	57·46
Water	8·15
	100·00

Gas per ton at 60 degs. Fahr. and 30 in. bar...	10,515 cubic feet
Illuminating power of gas	21·03 candles
Coke per ton of coal	1,287·10 lb.
Carbon in the coke	94·14 per cent.
Ash	5·86 per cent.
Sulphuretted hydrogen in foul gas	1·20 per cent.
Carbonic acid in foul gas..	3·00 per cent.

This coal possesses considerable lustre, is irregular in fracture, and cubical in cross-fracture. It yields a good volume of 21-candle power gas, and affords about 11½ cwt. of excellent coke.

Analyst—Geo. R. Hislop, F.C.S., &c.

Date of Analysis— . . . . . .

G. CROOKSTON AND SON,

Mount Florida, Glasgow.

Colliery—AIKENHEAD, Ell and Main Seams, Nos. 1 and 2 Pits.

Shipping Port—Glasgow.

Rail—Aikenhead Colliery Siding, *viâ* Newton, C.R.

Canal— . . . . . .

Aikenhead Cannel Coal.

Class of Coal—Gas.

		Per cent.
Volatile matters—		
Gas, tar, &c.	39·84	
Sulphur	0·42	
Water at 212 degs. Fahr. ..	8·70	
		48·96
Coke—		
Fixed carbon	47·92	
Sulphur	0·42	
Ash	2·70	
		51·04
		100·00

Notes.

LANARK.

Coke (dry), per ton of coal	10 cwt., 0 qrs., 23 lb.
	Per cent.
Analysis of the coke (dry)—	
Carbonaceous or combustible matter ..	93·89
Sulphur	0·82
Ash	5·29
	100·00
Specific gravity of the coal	1·273
Weight of 1 cubic foot	79·5 lb.
Gas per ton of coal, at 60 degs. Fahr. and 30 in. bar..	10,535 cubic feet
Illuminating power, in standard sperm candles, by union jet consuming 5 cubic feet per hour	23·35 candles
Value of 1 cubic foot of the gas in sperm ..	560 grains
Equivalent of 1 ton of the coal in sperm	842·8 lb.
Durability of 1 cubic foot of the gas, by 5 in. flame	48 min. 48 sec.
Specific gravity of the gas (air = 1·000) ..	·497

This coal yields a good volume of 23-candle gas and a coke of first-class quality.

Analyst—John Clark, Ph.D., F.C.S., &c.

Date of Analysis—March 11, 1893.

DARNGAVIL COAL COMPANY LIMITED,

40, St. Enoch Square, Glasgow.

Colliery—BIRKRIGG, ... Seam, ... Pit.

Shipping Ports—Glasgow, Greenock, Bo'ness, Grangemouth, Leith. Granton.

Rail—Caledonian, Dalserf Station.

Canal— . . . . . .

Birkrigg Virtuewell Coal.

Class of Coal— . . . . . .

		Per cent.
Volatile matter—		
Gas, tar, &c.	36·72	
Sulphur	0·30	
Water	9·28	
		46·30

Notes.

LANARK.

Birkrigg Virtuewell Coal—*cont.*

		Per cent.
Coke—		
Fixed carbon	52·05	
Sulphur	0·35	
Ash	1·30	
		53·70
		100·00
Specific gravity		1·25
Weight of 1 cubic foot		78·1 lb.
Heating power, practical, Playfair's formula (water at 212 degs. Fahr. evaporated by 1 lb. of coal)		7·90 lb.

Analysts—R. R. Tatlock and Thomson.
Date of Analysis—December 15, 1903.

Colliery—SWINHILL, ... Seam, ... Pit.
Shipping Ports—Glasgow, Greenock, Bo'ness, Grangemouth, Leith, Granton.
Rail—Caledonian, Stonehouse Station.
Canal— . . . .

Swinhill Lower Drumgray Coal.

Class of Coal— . . . .

		Per cent.
Volatile matter—		
Gas, tar, &c.	33·43	
Sulphur	0·26	
Water	9·96	
		43·65
Coke—		
Fixed carbon	54·11	
Sulphur	0·34	
Ash	1·90	
		56·35
		100·00
Specific gravity		1·25
Weight of 1 cubic foot		78·12 lb.
Heating power, practical, Playfair's formula (water at 212 degs. Fahr. evaporated by 1 lb. of coal)		8·06 lb.

Analysts—R. R. Tatlock and Thomson.
Date of Analysis—December 18, 1903.

Notes.

LANARK.

Colliery—WEST LONGRIGG, ... Seam, ... Pit.

Shipping Ports—Glasgow, Greenock, Bo'ness, Grangemouth, Leith, Granton.

Rail—North British, Longriggend Station.

Canal— . . . .

Darngavil Anthracite Coal.

Class of Coal—Anthracite.

		Per cent.
Volatile matter—		
Gas, tar, &c.	7·29	
Sulphur	0·06	
Water	1·95	
		9·30
Coke—		
Fixed carbon	87·89	
Sulphur	0·56	
Ash	2·25	
		90·70
		100·00
Specific gravity		1·35
Weight of 1 cubic foot		84·37 lb.
Heating power, practical, Playfair's formula (water at 212 degs. Fahr. evaporated by 1 lb. of coal)		11·64 lb.

Analysts—R. R. Tatlock and Thomson.

Date of Analysis—December 15, 1903.

Colliery—DARNGAVIL, ... Seam, ... Pit.

Shipping Ports—Glasgow, Greenock, Bo'ness, Grangemouth, Leith, Granton.

Rail—North British, Rawyards Station.

Canal— . . . .

Darngavil Heading Coal.

Class of Coal—Gas.

The coal is black, possesses considerable lustre and brown streak; fracture, irregular, and partly defined by intermittent deposits of charcoal; cross-fracture, angular to cubical, and largely defined by thin deposits of calcium carbonate and trace of ferric bisulphide; moderately

Notes.

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Darngavil Heading Coal—*cont.*

cohesive but compact; on the fire it intumeses and agglomerates; colour of ash, reddish brown; thickness of seam, 10 in.; mean specific gravity, 1·261 (water, 1·000); weight of one cubic foot, 78·81 lb.

		Per cent.
Volatile matters (containing 0·44 of sulphur)		34·14
Coke, consisting of—		
Carbon	57·66	
Sulphur	0·16	
Ash	3·44	
		61·26
Water expelled at 212 degs. Fahr.		4·60
		100·00

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar...	11,785 cubic feet
Gas from 1 cubic foot of the coal	414·41 cubic feet
Specific gravity of the gas	·561 (air 1·000)
Hydrocarbons absorbed by bromine	6·50 per cent.
Durability of 1 cubic foot by 5 in. jet flame ..	46 min. 38 sec.
Value of 1 cubic foot of gas in sperm	522·24 grains
Value of gas from 1 ton of coal in sperm ..	879·22 lb.
Illuminating power of gas in standard candles	21·76 candles
Sulphuretted hydrogen (H_2S) in foul gas ..	1·25 per cent.
Carbonic acid (CO_2) in foul gas	2·00 per cent.
Carbonic oxide (CO) in foul gas	6·75 per cent.
Sulphur eliminated with volatile products ..	9·86 lb.
Liquid products—	
Tar per ton of coal	10·15 gallons
Ammoniacal liquor per ton of coal	18·30 gallons
Strength of ammoniacal liquor..	2·66 degs. Twadd.
Hygrometric water per ton of coal	10·30 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	7·53 per cent.
Solid products—	
Coke per ton of coal	1,372·22 lb.
Carbon in the coke	94·40 per cent.
Ash in the coke	5·60 per cent.
Sulphur in coke per ton of coal	3·58 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	12·97 lb.

This is a remarkably good splint coal for the production of both gas and coke, as it affords a considerable quantity of both of excellent quality, and at the same time contains a very moderate amount of both sulphur and water. Compared with Main Lesmahagow cannel coal represented

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Notes.

by 100 (calculated on the basis of a production of 13,000 cubic feet of gas, and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products, and the cost of the purification of the gas), this coal is equal to 62·51.

Analyst—Geo. R. Hislop, F.C.S., etc.
Date of Analysis—February 24, 1894.

Colliery—DARNGAVIL, ... Seam, ... Pit.
Shipping Ports—Glasgow, Greenock, Bo'ness, Grangemouth, Leith, Granton.
Rail—North British, Whiterigg, Slamannan Stations.
Canal— . . . . . .

Darngavil Greyrigg Steam Coal.

Class of Coal—Steam.

		Per cent.
Volatile matter—		
Gas tar, &c.	18·001	
Sulphur	0·179	
Water	1·594	
		19·774
Coke—		
Fixed carbon	75·855	
Sulphur	0·347	
Ash	4·024	
		80·226
		100·000
Specific gravity		1·304
Heating power, practical (boiling water converted into steam by 1 lb. of the coal)		10·402 lb.

Analyst—G. C. Stewart.
Date of Analysis—October 19, 1891.

Notes.

LANARK.

Colliery—WEST LONGRIGG, ... Seam,
. . . . Pit.
Shipping Ports—Greenock, Glasgow, Granton, Grangemouth, Leith, Bo'ness.
Rail—North British, Longriggend and Slamannan Stations.
Canal— . . . .

West Longrigg Navigation Steam Coal.

Class of Coal—Steam.

		Per cent.
Volatile matter—		
Gas, tar, &c.	21·30	
Sulphur	0·10	
Water at 212 degs.	1·50	
		22·90
Coke (15 cwt. 47 lb.)—		
Fixed carbon	73·00	
Sulphur	0·10	
Ash	4·00	
		77·10
		100·00

Specific gravity of the coal	1·27
Weight of 1 cubic foot of the coal ..	79·37 lb.
Heating power (water at 212 degs. Fahr., which 1 lb. of coal can convert into steam)	10·02 lb.
Clinker and ash	4·00 per cent.

Analysis of the coke—	Per cent.
Fixed carbon	94·68
Sulphur	0·13
Ash	5·19
	100·00

Analyst—W. Wallace.
Date of Analysis—1886.

Another analysis—

		Per cent.
Volatile matter—		
Gas, tar, &c.	14·44	
Sulphur	0·10	
Water	1·76	
		16·30

Notes.

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Coke—		Per cent.
Fixed carbon	80·48	
Sulphur	0·52	
Ash	2·70	
		83·70
		100·00
Specific gravity		1·363
Weight of 1 cubic foot		85·18 lb.
Heating power, practical (water evaporated by 1 lb. of coal) ..		10·90 lb.

Analysts—R. R. Tatlock and Thomson.
Date of Analysis—July 5, 1898.

Mr. JAMES GEMMELL,

Netherburn.

Colliery—SOUTH LONGRIGG, ... Seam, ... Pit.

Shipping Ports—Bo'ness, Grangemouth, Glasgow.

Rail—Caledonian, Netherburn Station.

Canal—None.

Coking Dross Coal.

Class of Coal— . . . . . .

	Per cent.
(*a*)	
Ash	5·90
Sulphur	1·10
Volatile hydrocarbons	36·96
Fixed carbon	56·04
Yield of coke	62·60
Ash in coke	9·40
Sulphur in coke	0·99
(*b*)	
Moisture	1·7
Volatile matters	22·177
Coke yield	73·346
Ash	4·476

Analyst— . . . . . .
Date of Analysis— . . . . . .

Notes.

LANARK.

HIRST COAL COMPANY,

118, Queen Street, Glasgow.

Colliery—SOUTH BLAIR, Parrot Seam, South Blair Pit.
Shipping Ports—Glasgow, Grangemouth, Bo'ness, Leith.
Rail—North British, near Harthill Station.
Canal— . . . . . .

Parrot or Shale Coal.

Class of Coal—Gas.

A truckload of this coal gave, on examination, the following results:—

		Per cent.
Volatile matter (containing 0·62 of sulphur) ..		23·42
Coke—		
Carbon	57·31	
Sulphur	0·84	
Ash	17·24	
		75·39
Water expelled at 212 degs. Fahr.		1·19
		100·00

Analysis of coke—	Per cent.
Carbon	76·02
Sulphur	1·12
Ash	22·86
	100·00

Gas from 1 ton of coal at 60 degs. Fahr., and 30 in. bar...	8,521 cubic feet
Durability of 1 cubic foot of gas by 5 in. jet flame	55 min. 30 sec.
Illuminating power of gas in standard candles	26·01 candles
Value of gas from 1 ton of coal in sperm ..	759·87 lb.
Value of 1 cubic foot of gas in sperm	624·24 grains
Sulphur eliminated with volatile products ..	13·88 lb.
Coke (dry) per ton of coal	1,688·70 lb.
Sulphur in coke per ton of coal..	18·816 lb.
Tar and ammoniacal liquor per ton of coal ..	10·20 gallons

In obtaining the foregoing practical results, 2½ tons of the coal were distilled in the ordinary way in practical working, and the gas was collected in a separate holder for examination.

Analyst—Alexander Bell.

Date of Analysis—April 16, 1898.

Notes.

LANARK.

Virtuewell Coal.

Class of Coal—House.

		Per cent.
Volatile matter—		
Gas, tar, &c.	27·79	
Sulphur	0·17	
Water	2·04	
		30·00
Coke—		
Fixed carbon	67·16	
Sulphur	0·39	
Ash	2·45	
		70·00
Specific gravity		1·304
Weight of 1 cubic foot		81·5 lb.
Heating power, practical (water evaporated by 1 lb. of coal)		9·59 lb.

This is a coalseam of good quality. It may be regarded as a very clean coal, as it contains but little ash and is very free from sulphur.

Analysts—R. R. Tatlock, Readman, and Thomson.

Date of Analysis—February 19, 1897.

Colliery—HIRSTRIGG, Upper Drumgray Seam, Hirstrigg Pit.

Shipping Ports—Glasgow, Grangemouth, Bo'ness, Leith.

Rail—Caledonian, near Drumbrowie Station.

Canal— . . . .

Hirstrigg Special Steam Coal.

Class of Coal—Smokeless, Steam.

		Per cent.
Volatile matter—		
Gas, tar, &c.	22·07	
Sulphur	0·28	
Water	2·59	
		24·94
Coke—		
Fixed carbon	70·53	
Sulphur	0·86	
Ash	3·67	
		75·06
		100·00
Heating power, practical, Playfair's formula (water at 212 degs. Fahr. evaporated by 1 lb. of coal)		9·84 lb.

Notes.

LANARK.

Hirstrigg Special Steam Coal—*cont.*

The analysis shows that this is a steam coal of very high quality. All the constituent parts are present in splendid proportion, and it would make an admirable steam coal for yachts, as the amount of smoke produced would be very slight, and on account of the small proportion of ash it would be a very clean coal. It has a high heating or evaporative power, and is altogether a coal exceedingly well adapted for the purpose for which it is intended.

Analysts—R. R. Tatlock and Thomson, F.I.C., F.R.S.E., F.C.S.
Date of Analysis—March 9, 1903.

Hirstrigg Navigation Steam Coal.

Class of Coal—Steam.

		Per cent.
Volatile matter—		
Gas, tar, &c.	28·05	
Sulphur	0·22	
Water	1·78	
		30·05
Coke—		
Fixed carbon	66·84	
Sulphur	0·51	
Ash	2·60	
		69·95
		100·00

Heating power, practical, Playfair's formula (water at 212 degs. Fahr. evaporated by 1 lb. of coal)	9·55 lb.
Specific gravity	1·28
Weight of 1 cubic foot	80·00 lb.

This is a steam coal of very high excellence. On account of its freedom from ash and sulphur, it is a very clean coal, and the large proportion of fixed carbon ensures a high heating and evaporative power. It may be taken all round as being a steam coal of the very highest class, and it is also an excellent navigation coal.

This coal is not friable, and can be handled in transit by train or ship with the minimum production of smalls.

Analysts—R. R. Tatlock and Thomson, F.I.C., F.R.S.E., F.C.S.
Date of Analysis—October 3, 1902.

Notes.

LANARK.

Hirstrigg Anthracite Coal.

Class of Coal—Smokeless.

A sample of this coal gave on examination the following results:—

The coal possesses considerable lustre; fracture, rather irregular, partly defined by thin deposits of charcoal; cross-fracture, angular to cubical, and highly resinoid to crystalline, with traces only of ferric bisulphide in the natural partings; very uniform in stratification, composition and density; moderately cohesive and compact. Mean specific gravity, 1·289 (water 1·000); weight of 1 cubic foot, 80·56 lb. Cubic feet per ton, 27·80.

Proximate analysis.—The coal when heated to 2,000 degs. F. yields:—

		Per cent.	Lb. per ton,
Volatile matters (smokeless)	9·430		
Fixed carbon	85·218		
		94·648	2,120·115
Ash		1·770	39·648
Sulphur		0·832	18·637
Moisture		2·750	61·600
		100·000	2,240·000

Ultimate analysis:—Constituents of the coal—

	Per cent.
Carbon	88·427
Hydrogen	3·560
Nitrogen	0·853
Oxygen	1·808
Sulphur	0·832
Ash	1·770
Hygroscopic water	2·750
	100·000

Calorific or heat-producing power of the coal, as determined by Thomson's calorimeter:—

One pound of the coal by perfect combustion evolves heat sufficient to convert 15·12 lb. of water from 212 degs. Fahr. into steam.

One pound will therefore raise 14,605 lb. of water 1 deg. Fahr. in temperature,

or equal to 81·14 lb. of water from 32 degs. to 212 degs. Fahr.,

or equal to 96·08 lb. of water from 60 degs. to 212 degs. Fahr.,

or equal to 13·06 lb. of water from 60 degs. to 212 degs. Fahr., thence into steam.

This is an exceptionally pure and high-class anthracite coal, containing little ash and very moderate amounts of sulphur and water. It

Notes.

LANARK.

Hirstrigg Anthracite Coal—*cont.*

is extremely rich in fixed carbon, with great heating power, and contains a minimum percentage of volatile matter, thus rendering it practically smokeless, and therefore very suitable for malting, grain-drying, lime-burning, greenhouse stoves, or for any purpose where freedom from smoke is essential.

Analyst—Geo. R. Hislop, F.C.S., M.S.C.Ind., F.R.S.S.A.
Date of Analysis—December 13, 1900.

Hirstrigg Silkstone Coking Gas Coal.

Class of Coal—Gas.

		Per cent.
Volatile matter—		
Gas, tar, &c.	27·22	
Sulphur	0·27	
Water	1·54	
		29·03
Coke—		
Fixed carbon	64·38	
Sulphur	0·65	
Ash	5·94	
		70·97
		100·00
Specific gravity		1·28
Weight of 1 cubic foot		80 lb.
Coke (dry) per ton of coal		1,590 lb., or 14 cwt. 0 qr. 22 lb.
Analysis of the coke (dry)—		Per cent.
Fixed carbon		90·71
Sulphur		0·92
Ash		8·37
		100·00
Gas per ton of coal at 60 degs. F., and 30 in. bar.		9,527 cubic feet
Illuminating power in standard sperm candles by union jet consuming 5 cubic feet per hour at 0·5 in. pressure		18·35 candles
Illuminating power by London Argand ..		22·60 candles
Value of 1 cubic foot of gas in sperm		440·4 grains
Equivalent of 1 ton of coal in sperm		599·4 lb.
Durability of 1 cubic foot of gas		40 min.

This is a coal of very good quality, as it yields a large proportion of gas of high illuminating power, and is also a valuable coking coal. The coke is of excellent quality physically, and only contains average proportions of ash and sulphur.

Analysts—R. R. Tatlock and Thomson, F.I.C., F.R.S.E., F.C.S.
Date of Analysis—April 22, 1903.

LANARK.

Hirstrigg Parlour Coal.

Class of Coal—House and Gas.

		Per cent.
Volatile matters—		
Gas, tar, &c.	30·27	
Sulphur	0·28	
Water	2·20	
		32·75
Coke—		
Fixed carbon	64·73	
Sulphur	0·37	
Ash	2·15	
		67·25
		100·00
Specific gravity		1·25
Weight of 1 cubic foot in pounds ..		78·12
Heating power, practical, Playfair's formula (pounds of water at 212 degs. Fahr. evaporated by 1 lb. of coal)		9·35

This is a household coal of the very highest class. It makes a clear and lasty fire, gives exceedingly little ash of a reddish-brown colour, and as it is very free from sulphur, it would be found extremely satisfactory in every particular.

It also would make a very fine steam coal in every respect. It contains an unusually large proportion of fixed carbon, far less than the average of ash in steam coals, and the minimum of sulphur. It would be difficult to find a better or cleaner coal for steam-raising purposes. This will be obvious to everyone accustomed to consider the figures of coal analyses. This coal makes an excellent coke.

Analysts—R. R. Tatlock and Thomson.

Date of Analysis—January 31, 1908.

Notes.

LANARK.

KEIR AND MITCHELL,

Glenclelland, Wishaw.

Colliery—GLENCLELLAND, Shale above Virtuewell Seam, Glenclelland and Knownoble Pits.
Shipping Ports—Clyde and Forth ports.
Rail—Caledonian, Wishaw Station.
Canal— . . . .

Glenclelland Shale.

Class of Coal— . . . .

Colour, dull brownish black, with yellowish brown streak; fracture coarse and inclining to slaty, and exhibiting numerous small silvery planes or finely-diffused deposits of ferric-bisulphide; cross-fracture, angular and coarse, but clean in the partings; very compact and cohesive; in the retort it pretty much retains its form; thickness of seam, 4 in.; mean specific gravity, 1·296 (water, 1·000); weight of 1 cubic foot, 81 lb.

		Per cent.
Volatile matters (containing 0·56 of sulphur)		38·04
Coke, consisting of—		
Carbon	31·93	
Sulphur	0·37	
Ash	27·26	
		59·56
Water expelled at 212 degs. Fahr. ..		2·40
		100·00

Gaseous products—

Gas per ton of coal at 60 degs. Fahr., and 30 in. bar.	10,502 cubic feet
Gas from 1 cubic foot of the coal	379·76 cubic feet
Specific gravity of the gas	·588 (air 1·000)
Hydrocarbons absorbed by bromine ..	14·00 per cent.
Durability of 1 cubic foot by 5 in. jet flame	67 min. 10 sec.
Value of 1 cubic foot of gas in sperm ..	823·20 grains
Value of gas from 1 ton of coal in sperm ..	1,235·03 lb.
Illuminating power of gas in standard candles	34·30 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·80 per cent.
Carbonic acid (CO_2) in foul gas	2·00 per cent.
Carbonic oxide (CO) in foul gas	7·00 per cent.
Sulphur eliminated with volatile products	13·17 lb.

Notes.

LANARK.

Liquid products—

Tar per ton of coal	17·31 gallons
Ammoniacal liquor per ton of coal ..	9·45 gallons
Strength of ammoniacal liquor	3·00 degs. Twadd.
Hygrometric water per ton of coal ..	5·37 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	2·75 per cent.

Solid products—

Coke per ton of coal	1,234·14 lb.
Carbon in the coke	54·24 per cent.
Ash in the coke	45·76 per cent.
Sulphur in coke per ton of coal	7·66 lb.
Heating-power of 1 lb. of coke (water from boiling point into steam)	7·45 lb.

Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas), this shale is equal to 70·24.

Analyst—Geo. R. Hislop, F.C.S., etc.

Date of Analysis—June 15, 1889.

Glenclelland Caking Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

Colour, dullish black; fracture, rather coarse, with deposits of fibrous charcoal; cross-fracture exhibits numerous alternate laminations possessing slightly varying lustre, as also trace of ferric-bisulphide in the natural partings; moderately friable but rather porous; on the fire it intumesces and agglomerates; colour of ash, greyish brown; thickness of seam, 29 in.; mean specific gravity, 1·282 (water 1·000); weight of 1 cubic foot, 80·25 lb.

		Per cent.
Volatile matters (containing 0·31 of sulphur)		36·11
Coke, consisting of—		
Carbon	52·70	
Sulphur	0·21	
Ash	3·38	
		56·29
Water expelled at 212 degs. Fahr.		7·60
		100·00

Notes.

LANARK.

Glenclelland Caking Coal—*cont.*

Gaseous products—

Gas per ton of coal at 60 degs. Fahr., and 30 in. bar	10,770 cubic feet
Gas from 1 cubic foot of the coal	379·20 cubic feet
Specific gravity of the gas	·482 (air 1·000)
Hydrocarbons absorbed by bromine ..	6·66 per cent.
Durability of 1 cubic foot by 5 in. jet flame	47 min. 50 sec.
Value of 1 cubic foot of gas in sperm ..	538·08 grains
Value of gas from 1 ton of coal in sperm ..	827·87 lb.
Illuminating power of gas in standard candles	22·42 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·20 per cent.
Carbonic acid (CO_2) in foul gas	3·10 per cent.
Carbonic oxide (CO) in foul gas	6·75 per cent.
Sulphur eliminated with volatile products	7·29 lb.

Liquid products—

Tar per ton of coal	17·10 gallons
Ammoniacal liquor per ton of coal ..	30·50 gallons
Strength of ammoniacal liquor	2·50 degs. Twadd.
Hygrometric water per ton of coal ..	17·02 gallons
Aqueous absorbent capacity of coal (determined by complete saturation) ..	11·30 per cent.

Solid products—

Coke per ton of coal	1,260·89 lb.
Carbon in the coke	94·00 per cent.
Ash in the coke	6·00 per cent
Sulphur in the coke per ton of coal ..	4·35 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	12·91 lb.

Compared with Main Lesmahagow cannel coal, represented by 100 calculated on the basis of a production of 13,000 cubic feet of gas, and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 59·95.

Analyst—Geo. R. Hislop, F.C.S., etc.
Date of Analysis—June 3, 1889.

LANARK.

Notes.

A. G. MOORE AND CO.,

142, St. Vincent Street, Glasgow.

Colliery—BLANTYREFERME, Virgin Coal Seam, Blantyreferme Pit.
Shipping Port—Glasgow.
Rail—Caledonian Railway, Uddingston Station.
Canal— . . . .

Blantyreferme House Coal.

Class of Coal—House.

	Per cent.
Gas, tar, &c.	36·39
Water	10·11
Fixed carbon	49·61
Ash	3·89
	100·00

Analysts—R. R. Tatlock and Thomson, F.I.C.
Date of Analysis—September 23, 1902.

Colliery—BLANTYREFERME, Ell Coal Seam, Blantyreferme Pit.

Blantyreferme Ell Coal.

Class of Coal—Gas Coal.

Gas per ton of coal	9,070 cubic feet
Illuminating power in standard candles ..	17·57 candles
Sperm equivalent	542·7
Coke per ton of coal	1,300 lb.
Ash in coke	10·02 per cent.
Silica in coke	5·72 per cent.
Sulphur in coke	1·25 per cent.
Phosphorus in coke	0·037

Analyst—Working analysis of coal, as tested at Glasgow Corporation Gas Works.
Date of Analysis—April, 1903.

Colliery—BLANTYREFERME, Splint Coal Seam, Blantyreferme Pit.

Blantyreferme Splint Coal.

Class of Coal—Gas and Foundry Coal.

Gas per ton of coal	9,559 cubic feet
Illuminating power	19 standard candles
Coke per ton of coal	1,285 lb.
Ash in coke..	7·80 per cent.
Sperm equivalent	622

Analyst—Working analysis of coal, as tested at Glasgow Corporation Gas Works.
Date of Analysis—May, 1905.

Notes.

LANARK.

JAMES NIMMO AND CO. LIMITED,

21, Bothwell Street, Glasgow.

Colliery—LONGRIGG, ... Seam, ... Pit
Shipping Port— . . . .
Rail— . . . . Station.
Canal— . . . .

Longrigg Anthracite Coal.

Class of Coal— . . . .

	Per cent.
Moisture	2·87
Ash	2·04
Volatile matter	6·45
Fixed carbon	88·64
	100·00

This is one of the best samples of anthracite coal which I have had the opportunity of examining. It is a coal of quite exceptional purity. It is bright and lustrous in appearance, and very hard. It burns without evolution of smoke.

I have made a rigorous examination of the coal for arsenic, by a method capable of determining accurately less than one-tenth of a grain of arsenic per pound of coal, and find that no trace of arsenic exists. It is therefore eminently suited for the use of maltsters and others requiring a high-class smokeless fuel.

Analyst—W. Carrick Anderson, M.A., D.Sc.
Date of Analysis—August 11, 1903.

Longrigg Navigation Steam Coal.

Class of Coal—Steam.

	Dried sample. Per cent.
Carbon	87·65
Hydrogen	4·90
Oxygen	2·15
Nitrogen	2·57
Sulphur	0·91
Ash	1·82
	100·00

Notes.

LANARK.

	Per cent.
Fixed carbon	75·75
Volatile matters (other than sulphur and water)	19·78
Sulphur and water	4·47
	100·00

	Per cent.
Specific gravity (water expelled at 60 degs. Fahr., 1·000)	1·303
Nature of the coal	Sinter
Colour of ash	Buff
Calculated total heat units (by Dulong's formula)	8,697 units
Calorific power (by Thompson's calorimeter)	7,645
Net theoretical evaporative power (by calculation)	15·72 lb.
Evaporative power, by calorimeter (water at 212 degs. Fahr. converted into steam at same temperature)	14·26 lb.

This is a remarkably fine steam coal of the bituminous type. It contains a very small proportion of ash, and the percentages of carbon and hydrogen are not only high, but—what is very important from a heat-giving point of view—they are combined with an exceedingly small amount of oxygen. The nitrogen, as I have frequently found to be the case in Scotch coals of this class, is high, but the oxygen and nitrogen together amount only to 4·72 per cent.

This coal is equal to any of the Monmouthshire steam coals with which I am acquainted, and is surpassed only by the best Welsh.

Analyst—W. Carrick Anderson, M.A., D.Sc.
Date of Analysis—June 1, 1904.

Nimmo's Holytown Best House Coal.

Class of Coal—House.

	Per cent.
Moisture	8·65
Ash	2·19
Volatile matter	33·70
Fixed carbon	55·46
	100·00

Analyst—W. Carrick Anderson, M.A., D.Sc.
Date of Analysis—August 11, 1903.

Notes.

LANARK.

Nimmo's Hartley Hamilton Ell Coal.

Class of Coal— . . . .

	Per cent.
Moisture	8·65
Ash	2·19
Volatile matter	33·70
Fixed carbon	55·46
	100·00

Analyst—W. Carrick Anderson, M.A., D.Sc.
Date of Analysis—August 11, 1903.

Mr. J. PARK,

Holytown.

Colliery—LINRIGG, Upper Drumgray Seam, Nos. 1, 6 and 7 Pits.
Shipping Port—Glasgow.
Rail—Caledonian, Salisburgh Station.
Canal— . . . . . .

Linrigg Splint Coal.

Class of Coal—Manufacturing, House.

A sample of this coal, representing the entire product of the seam, gave on examination the following results:—

This seam consists of 13 in. of free coal and 9 in. hard splint; colour generally dullish black; fractures irregular in the free coal to semi-slaty in the splint, the former containing considerable deposits of vegetable charcoal, as also slight deposits of ferric bisulphide and calcium carbonate in the natural partings. The free coal is friable and porous, the splint moderately compact and cohesive. On the fire the free portion intumesces and slightly agglomerates; colour of ash, pale brown; mean specific gravity, 1·248 (water 1·000); weight of 1 cubic foot, 78·0 lb.

		Per cent.
Volatile matters (containing 0·43 of sulphur)		36·18
Coke, consisting of—		
Carbon	51·98	
Sulphur	0·24	
Ash	3·40	
		55·62
Water expelled at 212 degs. Fahr.		8·20
		100·00

Notes.

Lanark.

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	10,345 cubic feet
Gas from 1 cubic foot of the coal	360·22 cubic feet
Specific gravity of the gas	·478 (air 1·000)
Hydrocarbons absorbed by bromine ..	6·20 per cent.
Durability of 1 cubic foot by 5 in. jet flame	43 min. 28 sec.
Value of 1 cubic foot of gas in sperm ..	482·88 grains
Value of gas from 1 ton of coal in sperm	713·62 lb.
Illuminating power of gas in standard candles	20·12 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·40 per cent.
Carbonic acid (CO_2) in foul gas	2·75 per cent.
Carbonic oxide (CO) in foul gas	7·75 per cent.
Sulphur eliminated with volatile products	9·63 lb.
Liquid products—	
Tar per ton of coal	18·40 gallons
Ammoniacal liquor per ton of coal ..	33·60 gallons
Strength of ammoniacal liquor	2·5 degs. Twadd.
Hygrometric water per ton of coal ..	18·36 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	12·54 per cent.
Solid products—	
Coke per ton of coal	1,245·88 lb.
Carbon in the coke	93·90 per cent.
Ash in the coke	6·10 per cent.
Sulphur in coke per ton of coal	5·37 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	12·90 lb.

While yielding a good volume of fully 20-candle gas, this splint coal affords upwards of 11 cwt. of first-class coke, and contains a moderate percentage of sulphur, but fully the average amount of water. Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 54·04.

Analyst—Geo. R. Hislop, F.C.S., F.R.S.S.A.
Date of Analysis—April 11, 1891.

Notes.

LANARK.

SHOTTS IRON COMPANY,

130, George Street, Edinburgh.

Colliery—CASTLEHILL, Drumgray Seam, ... Pit.
Shipping Ports—Glasgow, Grangemouth, Bo'ness, Leith.
Rail—North British and Caledonian, Carluke Station.
Canal—None.

Castlehill Coal.

Class of Coal—Steam.

A sample of this coal, representing the entire product of the seam, gave on examination the following results:—

		Per cent.
Volatile matters (containing 0·47 sulphur)		33·99
Coke, consisting of—		
Carbon	55·12	
Sulphur	0·21	
Ash	2·43	
		57·76
Water expelled at 212 degs. Fahr. ..		8·25
		100·00

Analyst—Geo. R. Hislop, F.C.S., F.R.S.S.A.
Date of Analysis—March 19, 1892.

JOHN WATSON LIMITED,

53, Bothwell Street, Glasgow.

Colliery—EDDLEWOOD, Splint Seam, ... Pit.
Shipping Ports—Glasgow, Greenock, Ardrossan, Grangemouth, Leith.
Rail—Caledonian, Meikle Earnock Station.
Canal—None.

Eddlewood Cannel Coal.

Class of Coal—Gas.

A sample of this coal, representing the entire product of the seam, gave on examination the following results:—

		Per cent.
Volatile matters (containing 0·44 of sulphur)		36·75
Coke, consisting of—		
Carbon	53·57	
Sulphur	0·36	
Ash	2·72	
		56·65
Water expelled at 212 degs. Fahr... ..		7·60
		100·00

Notes.

LANARK.

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar.	10,650 cubic feet
Gas from 1 cubic foot of the coal	373·22 cubic feet
Specific gravity of the gas	·506 (air 1·000)
Hydrocarbons absorbed by bromine ..	7·60 per cent.
Durability of 1 cubic foot by 5 in. jet flame	48 min. 16 sec.
Value of 1 cubic foot of gas in sperm ..	557·28 grains
Value of gas from 1 ton of coal in sperm	847·86 lb.
Illuminating power of gas in standard candles	23·22 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·33 per cent.
Carbonic acid (CO_2) in foul gas	2·75 per cent.
Carbonic oxide (CO) in foul gas	7·20 per cent.
Sulphur eliminated with volatile products	9·86 lb.
Liquid products—	
Tar per ton of coal	16·52 gallons
Ammoniacal liquor per ton of coal ..	31·80 gallons
Strength of ammoniacal liquor	2·50 degs. Twadd.
Hygrometric water per ton of coal ..	17·02 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	10·60 per cent.
Solid products—	
Coke per ton of coal	1,268·96 lb.
Carbon in the coke	95·20 per cent.
Ash in the coke	4·80 per cent.
Sulphur in coke per ton of coal	8·06 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	13·08 lb.

Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas) this coal is equal to 63·15.

Analyst—Geo. R. Hislop, F.C.S., F.R.S.S.A.

Date of Analysis—April 28, 1891.

Notes.

Lanark.

Colliery—Neilsland, ... Seam, ... Pit.

Watson's Neilsland Best House Coal.

Class of Coal—House.

		Per cent.
Volatile matter—		
Gas, tar, &c.	34·63	
Sulphur	0·32	
Water	11·45	
		46·40
Coke—		
Fixed carbon	51·79	
Sulphur	0·36	
Ash	1·45	
		53·60
		100·00

Specific gravity	1·30
Weight of 1 cubic foot	81·25 lb.
Heating power, practical, Playfair's formula (water at 212 degs. Fahr. evaporated by 1 lb. of coal)	7·80 lb.
Colour of ash	Light brown.

Analysts—R. R. Tatlock and Thomson.

Date of Analysis—February 18, 1905.

Watson's Neilsland Ell House Coal.

Class of Coal—House.

		Per cent.
Volatile matter—		
Gas, tar, &c.	36·21	
Sulphur	0·45	
Water	10·74	
		47·40
Coke—		
Fixed carbon	50·40	
Sulphur	0·50	
Ash	1·70	
		52·60
		100·00

Specific gravity	1·30
Weight of 1 cubic foot	81·25 lb.
Heating power, practical, Playfair's formula (water at 212 degs. Fahr. evaporated by 1 lb. of coal)	7·67 lb.
Colour of ash	Light brown.

Analysts—R. R. Tatlock and Thomson.

Date of Analysis—February 18, 1905.

Notes.

LANARK.

Collieries—EARNOCK, EDDLEWOOD, NEILSLAND and MOTHERWELL,
. . . . Seam, ... Pit.
Shipping Ports—Glasgow, Greenock, Ardrossan, Grangemouth, Leith.
Rail—Caledonian and North British, Hamilton and Motherwell Stations.
Canal—None.

Watson's Duke of Hamilton Splint Coal.

Class of Coal— . . . . . .

A sample of this coal, representing the entire product of the seam, gave on examination the following results:—

The coal is dull brownish black to black, with considerable lustre; fracture in part inclines to slaty, undulating, and in part irregular and more friable, with deposits of ferric bisulphide and calcium carbonate in the natural partings; under distillation the free portion intumesces and agglomerates; colour of ash, brownish white; thickness of seam, 22 in.; mean specific gravity, 1·257 (water 1·000); weight of 1 cubic foot, 78·56 lb.

		Per cent.
Volatile matters (containing 0·62 of sulphur)		35·96
Coke, consisting of—		
Carbon	52·16	
Sulphur	0·15	
Ash	4·87	
		57·18
Water expelled at 212 degs. Fahr. ..		6·86
		100·00

Gaseous products—

Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	11,135 cubic feet
Gas from 1 cubic foot of the coal	393·19 cubic feet
Specific gravity of the gas	·505 (air = 1·000)
Hydrocarbons absorbed by bromine ..	6·25 per cent.
Durability of 1 cubic foot by 5 in. jet flame	45 min. 36 sec.
Value of 1 cubic foot of gas in sperm ..	509·28 grains
Value of gas from 1 ton of coal in sperm ..	810·11 lb.
Illuminating power of gas in standard candles (per London Argand)	21·22 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·66 per cent.
Carbonic acid (CO_2) in foul gas	3·50 per cent.
Carbon oxide (CO) in foul gas	9·00 per cent.
Sulphur eliminated with volatile products	13·88 lb.

Notes.

LANARK.

Watson's Duke of Hamilton Splint Coal—*cont.*

Liquid products—

Tar per ton of coal	17·50 gallons
Ammoniacal liquor per ton of coal ..	26·25 gallons
Strength of ammoniacal liquor	2·50 degs. Twadd.
Hygrometric water per ton of coal ..	15·36 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	9·20 per cent.

Solid products—

Coke per ton of coal	1,280·83 lb.
Carbon in the coke	91·50 per cent.
Ash in the coke	8·50 per cent.
Sulphur in coke per ton of coal	3·36 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	12·57 lb.

Compared with Main Lesmahagow cannel coal represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas and 1,535·5 lb. of sperm value per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 56·63.

Analyst—Geo. R. Hislop, F.C.S., F.R.S.S.A.

Date of Analysis—April 9, 1900.

WILSONS AND CLYDE COAL COMPANY LIMITED,

75, Bothwell Street, Glasgow.

Colliery—SHAWFIELD, ... Seam, ... Pit.

Shipping Port— . . . .

Rail— . . . . Station.

Canal— . . . .

Shawfield Splint Coal.

Class of Coal—Gas (?)

		Per cent.
Volatile matters—		
Gas, tar, &c.	35·55	
Sulphur	0·32	
Water at 212 degs. Fahr...	7·00	
		42·87
Coke—		
Fixed carbon	53·79	
Sulphur	0·38	
Ash	2·96	
		57·13
		100·00

Notes.

LANARK.

Coke (dry) per ton of coal, 1,280 lb., or 11 cwt. 1 qr. 20 lb.

Analysis of coke (dry)—	Per cent.
Carbonaceous or combustible matter ..	94·15
Sulphur	0·67
Ash	5·18
	100·00

Specific gravity of coal	1·287
Weight of 1 cubic foot in pounds	80 lb.
Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	94·55 cubic feet
Illuminating power in standard sperm candles by union jet consuming 5 cubic feet per hour at 0·5 in. pressure	16·50 candles
Value of 1 cubic foot of gas in sperm ..	396 grains
Equivalent of a ton of coal in sperm ..	535 lb.
Durability of 1 cubic foot of gas by 5 in. flame	40 min. 30 sec.
Specific gravity of the gas (air 1·000) ..	·458

The sample consisted of a truck load weighing 5 tons 8 cwt., of which 4 tons 16 cwt. were used in the trial. By Sugg's London Argand—as used in English gasworks for testing gas—the illuminating power was found to be 19·22 candles, equal to 461 grains of sperm per cubic foot of gas, and to 622 lb. of sperm per ton of coal. The coke is of excellent quality as regards both sulphur and ash.

Analyst— . . . . . .

Date of Analysis— . . . . . .

Colliery—CLYDE, ... Seam, ... Pit.

Ell or Household Coal.

Class of Coal—House.

Volatile matters—		Per cent.
Gases, tar, &c.	34·76	
Sulphur	0·20	
Water at 212 degs. Fahr. ..	9·25	
		44·21
Coke—		
Fixed carbon	53·22	
Sulphur	0·12	
Ash	2·45	
		55·79
		100·00

Notes.

LANARK.

Ell or Household Coal—*cont.*

Coke, per ton of coal, 1,250 lb., or ..	11·0·18 cwt.
Composition of the coke (dry)—	
Carbonaceous or combustible matter	95·40
Sulphur	0·21
Ash	4·39
	100·00
Specific gravity	1·287
Weight of 1 cubic foot	80 lb.
Space required for stowage, per ton ..	42 cubic feet
Heating or evaporating power, practical, in pounds of water at 212 degs., converted into steam by the combustion of 1 lb. of coal	8·01 lb.

The Ell coal in the Hamilton district has long had the reputation of being one of the best household coals obtained in the Scottsh coalfields, burning readily, and with a bright cheerful flame, giving only a trifling amount of ash, and being comparatively free from sulphur. The present sample possesses all these qualities, and is particularly adapted for domestic use. Besides being sold locally for household purposes, this coal is largely exported. It is considered one of the best of the first-class Ell or Hartley coals.

Analyst— . . . . . .
Date of Analysis— . . . . . .

Clyde Splint Coal.

Class of Coal—Gas.

Colour, dull brownish black, with brown streak; fracture semi-slaty and undulating, with slight deposits of vegetable charcoal; cross-fracture rather dull, coarse and angular, and partly exhibiting alternate laminæ of bright bituminous and dull coal, as also slight deposits of ferric bisulphide and calcium carbonate; massive and cohesive but rather porous; on the fire it partially and very slightly intumesces; colour of ash, pinkish white; thickness of seam, 27 in; mean specific gravity, 1·257 (water 1·000); weight of 1 cubic foot, 78·57 lb.

		Per cent.
Volatile matters (containing 0·45 of sulphur)		34·04
Coke, consisting of—		
Carbon	55·08	
Sulphur	0·28	
Ash	2·80	
		58·16
Water expelled at 212 degs. Fahr. ..		7·80
		100·00

Notes.

LANARK.

Gaseous products—

Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	10,615 cubic feet
Gas from 1 cubic foot of the coal	372·28 cubic feet
Specific gravity of the gas	·476 (air 1·000)
Hydrocarbons absorbed by bromine ..	6·50 per cent.
Durability of 1 cubic foot by 5 in. jet flame	44 min. 48 sec.
Value of 1 cubic foot of gas in sperm ..	509·76 grains
Value of gas from 1 ton of coal in sperm ..	758·73 lb.
Illuminating power of gas in std. candles	21·24 candles
Sulphuretted hydrogen (H_2S) in foul gas ..	1·30 per cent.
Carbonic acid (CO_2) in foul gas	2·50 per cent.
Carbonic oxide (CO) in foul gas	8·25 per cent.
Sulphur eliminated with volatile products	10·07 lb.

Liquid products—

Tar per ton of coal	16·30 gallons
Ammoniacal liquor per ton of coal ..	30·20 gallons
Strength of ammoniacal liquor	2·50 degs. Twadd.
Hygrometric water per ton of coal ..	17·47 gallons
Aqueous absorbent capacity of coal (determined by complete saturation) ..	12·00 per cent.

Solid products—

Coke per ton of coal	1,302·78 lb.
Carbon in the coke	95·20 per cent.
Ash in coke	4·80 per cent.
Sulphur in coke per ton of coal	6·28 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	13·08 lb.

This is an excellent splint coal. It parts with its volatile products speedily at a moderate temperature; yields a considerable amount of illuminating matter, and 11·63 cwt. of first-class coke per ton, and contains at same time a moderate percentage of sulphur, with about the average amount of water. Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas, and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products, and the cost of the purification of the gas), this coal is equal to 57·52.

Analyst—Geo. R. Hislop, F.C.S., F.R.S.S.A.
Date of Analysis— . . . . . .

Notes.

LANARK.

Colliery—DOUGLAS PARK, ... Seam, ... Pit.

Clyde Cannel Coal.

Class of Coal—Gas.

A sample of this coal, representing the entire product of the seam, gave on examination the following results :—

Colour black, with moderate lustre and brown streak; fracture irregular and undulated; cross-fracture inclining to small conchoidal, with slight deposits of ferric bisulphide in the natural partings; moderately cohesive, but rather porous; on the fire it decrepitates and flies partially, and very slightly intumesces; colour of ash, pinkish white; thickness of seam 5 to 7½ inches; mean specific gravity, 1·262 (water 1·000); weight of 1 cubic foot, 78·9 lb.

		Per cent.
Volatile matters (containing 0·44 of sulphur)		36·79
Coke consisting of—		
Carbon	52·77	
Sulphur	0·31	
Ash	3·63	
		56·71
Water expelled at 212 degs. Fahr. ..		6·50
		100·00

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	10,904 cubic feet
Gas from 1 cubic foot of coal	379·61 cubic feet
Specific gravity of the gas	·520 (air 1·000)
Hydrocarbons absorbed by bromine ..	8·60 per cent.
Durability of 1 cubic foot by 5 in. jet flame	53 min. 40 sec
Value of 1 cubic foot of gas in sperm ..	620·40 grains
Value of gas from 1 ton of coal in sperm	966·40 lb.
Illuminating power of the gas in standard candles	25·85 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·30 per cent.
Carbonic acid (CO_2) in foul gas	3·00 per cent.
Carbonic oxide (CO) in foul gas	7·10 per cent.
Sulphur eliminated with volatile products	9·92 lb.
Liquid products—	
Tar per ton of coal	18·80 gallons
Ammoniacal liquor per ton of coal ..	25·10 gallons
Strength of ammoniacal liquor	2·50 degs. Twadd.
Hygrometric water per ton of coal ..	14·56 gallons
Aqueous absorbent capacity of coal (determined by complete saturation) ..	10·10 per cent.

LANARK.

Notes.

Solid products—

Coke per ton of coal	1,260·20 lb.
Carbon in the coke	93·60 per cent.
Ash in the coke	6·40 per cent.
Sulphur in coke per ton of coal	6·88 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	12·86 lb.

This is an excellent coal for the production of both gas and coke, as in addition to yielding a considerable volume of good gas, it affords 11 cwt. of first-class coke, and contains a moderate amount of sulphur. Compared with Main Lesmahagow cannel coal represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas, and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 68·38.

Analyst—Geo. R. Hislop, F.C.S., F.R.S.S.A.

Date of Analysis— . . . . . .

Douglas Park Splint Coal.

Class of Coal—Gas.

		Per cent.
Volatile matters—		
Gas, tar, &c.	34·88	
Sulphur	0·24	
Water at 212 degs. Fahr. ..	5·06	
		40·18
Coke—		
Fixed carbon	55·08	
Sulphur	0·36	
Ash	4·38	
		59·82
		100·00

Coke (dry) per ton of coal—1,340 lb., or 11 cwt. 3 qr. 24 lb.

Analysis of the coke (dry)—	Per cent.
Carbonaceous or combustible matter	92·08
Sulphur	0·60
Ash	7·32
	100·00
Specific gravity of the coal	1·271
Weight of 1 cubic foot	79 lb.

Notes.

LANARK.

Douglas Park Splint Coal—*cont.*

Gas per ton of coal at 60 degs. Fahr., and 30 in. bar.	10,425 cubic feet
Illuminating power in standard sperm candles, by union jet, consuming 5 cubic feet per hour at 0·5 in. pressure	20·26 candles
Value of 1 cubic foot of gas in sperm	486 grains
Equivalent of a ton of coal in sperm	724 lb.
Durability of 1 cubic foot of gas by 5 in. flame	48 min. 12 sec.
Gravity of the gas (air 1·000)	·475

The sample weighed 6 tons 3 cwt., and 5 tons 8 cwt. were used in the trial. By Sugg's London Argand, as employed in English gas-works, the gas had an illuminating power of 22·23 candles, equal to 533 grains of sperm per cubic foot, and to 794 lb. of sperm per ton of coal. The coke is of excellent quality.

These "splint" coals are used in the principal iron and steel and other works in the vicinity of the collieries. They are also shipped to foreign markets, especially to South America, with the best results.

Analyst— . . . . . .
Date of Analysis— . . . . . .

Colliery—WELLHALL (?) . . . . Seam, ... Pit.

Wellhall Cannel Coal.

Class of Coal—Gas.

The coal is black and possesses high lustre and brown streak; fracture irregular, and partly inclining to scalariform, with impressions of stigmaria; cross-fracture, conchoidal, with deposits of calcium carbonate and ferric bisulphide in the natural partings; moderately compact and cohesive; on the fire it intumesces and agglomerates; colour of ash, pale yellow and flocculent; thickness of seam, 6 to 7½ inches; mean specific gravity, 1·233 (water 1·000); weight of 1 cubic foot, 77·06 lb.

		Per cent.
Volatile matters (containing 0·38 of sulphur)		43·85
Coke, consisting of—		
Carbon	46·66	
Sulphur	0·16	
Ash	2·68	
		49·50
Water expelled at 212 degs. Fahr. ..		6·65
		100·00

LANARK.

Notes.

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar.	11,225 cubic feet
Gas from 1 cubic foot of the coal	386·16 cubic feet
Specific gravity of the gas	·646 (air 1·000)
Hydrocarbons absorbed by bromine ..	11·25 per cent.
Durability of 1 cubic foot by 5 in. jet flame	60 min. 18 sec.
Value of 1 cubic foot of gas in sperm ..	710·88 grains
Value of gas from 1 ton of coal in sperm ..	1,138·25 lb.
Illuminating power of gas in standard candles	29·62 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·20 per cent.
Carbonic acid (CO_2) in foul gas	2·75 per cent.
Carbonic oxide (CO) in foul gas	11·25 per cent.
Sulphur eliminated with volatile products	8·50 lb.
Liquid products—	
Tar per ton of coal	20·72 gallons
Ammoniacal liquor per ton of coal ..	27·50 gallons
Strength of ammoniacal liquor	2·50 degs. Twadd.
Hygrometric water per ton of coal	14·86 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	9·20 per cent.
Solid products—	
Coke per ton of coal	1,108·8 lb.
Carbon in the coke	94·60 per cent.
Ash in the coke	5·40 per cent.
Sulphur in coke per ton of coal	3·59 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	12·99 lb.

This coal is very easily distilled, yields a considerable volume of 29·65-candle gas, and at same time affords well nigh 10 cwt. first-class coke. The percentage of sulphur is also very moderate. Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas, and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products, and the cost of the purification of the gas), this coal is equal to 79·71.

Analyst—Geo. R. Hislop, F.C.S., F.R.S.S.A.
Date of Analysis— . . . .

Notes.

LANARK.

WISHAW COAL COMPANY LIMITED,

Motherwell.

Collieries—DALZELL and BROOMSIDE, ... Seam, ... Pit.
Shipping Ports—Glasgow, Greenock, Leith, Grangemouth, Ardrossan.
Rail—Caledonian, Motherwell Station.
Canal— . . . .

Broomside Cannel Coal.

Class of Coal—Gas.

A sample of this coal, representing the entire product of the seam, gave on examination the following results :—

Colour black, with moderate lustre and brownish streak. Fracture inclining to slaty and partly undulated. Cross-fracture slightly conchoidal, and exhibiting in natural partings slight deposits of calcium carbonate and pyrites; moderately cohesive and massive, but rather porous. On the fire it decrepitates and flies, but does not intumesce nor agglomerate; colour of ash, white; thickness of seam, 20 in., and well defined; mean specific gravity, 1·287 (water 1·000); weight of 1 cubic foot, 80·44 lb.

		Per cent.
Volatile matters (containing 0·43 of sulphur)		35·93
Coke, consisting of—		
Carbon	51·01	
Sulphur	0·25	
Ash	6·11	
		57·37
Water expelled at 212 degs. Fahr. ..		6·70
		100·00
Gaseous products—		
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar.		10,521 cubic feet
Gas from 1 cubic foot of the coal		377·77 cubic feet
Specific gravity of the gas		·491 (air 1·000)
Hydrocarbons absorbed by bromine ..		8·75 per cent.
Durability of 1 cubic foot by 5 in. jet flame		50 min. 10 sec.
Value of 1 cubic foot of gas in sperm ..		584·64 grains
Value of gas from 1 ton of coal in sperm ..		878·71 lb.
Illuminating power of gas in standard candles		24·36 candles
Sulphuretted hydrogen (H_2S) in foul gas		1·60 per cent.
Carbonic acid (CO_2) in foul gas		2·50 per cent.
Carbonic oxide (CO) in foul gas		5·00 per cent.
Sulphur eliminated with volatile products		9·63 lb.

Notes.

LANARK.

Liquid products—

Tar per ton of coal	19·35 gallons
Ammoniacal liquor per ton of coal ..	25·50 gallons
Strength of ammoniacal liquor	3·00 degs. Twadd.
Hygrometric water per ton of coal ..	15·00 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	10·30 per cent.

Solid products—

Coke per ton of coal	1,285·08 lb.
Carbon in the coke	89·36 per cent.
Ash in the coke	10·64 per cent.
Sulphur in coke per ton of coal	5·60 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	12·27 lb.

The foregoing results compare favourably with those from the best cannels from the Lanarkshire Splint seam. Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas, and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 63·13.

Analyst—Geo. R. Hislop, F.C.S., F.R.S.S.A.
Date of Analysis—May 17, 1888.

WOODSIDE COAL COMPANY LIMITED,

Netherburn, by Hamilton.

Colliery—WOODSIDE, Virtuewell Seam, No. 2 Pit.
Shipping Ports—Scottish ports, principally Glasgow.
Rail—Caledonian, Motherwell Station.
Canal—None.

Woodside Virtuewell Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

The coal is black, possesses moderate lustre and brown streak; fracture irregular to regular, and in part alternately laminated with splint and bituminous coal, and containing thin deposits of charcoal and some impressions of stigmaria. Cross-fracture, angular to cubical and resinoid, with deposits of calcium carbonate and ferric bisulphide. Under distillation it intumesces and agglomerates. Colour of ash, brown. Moderately cohesive but rather porous. Thickness of seam, 26 in.; mean specific gravity, 1·218 (water 1·000); weight of 1 cubic foot, 76·16 lb.

Notes.

LANARK.

Woodside Virtuewell Coal—*cont.*

		Per cent.
Volatile matters (containing 0·55 of sulphur)		36·24
Coke, consisting of—		
Carbon	54·38	
Sulphur	0·12	
Ash	1·98	
		56·48
Water expelled at 212 degs. Fahr. ..		7·28
		100·00

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar	11,610 cubic feet
Gas from 1 cubic foot of the coal	394·74 cubic feet
Specific gravity of the gas	·486 (air 1·000)
Hydrocarbons absorbed by bromine ..	6·00 per cent.
Durability of 1 cubic foot by 5 in. jet flame	44 min. 26 sec.
Value of 1 cubic foot of gas in sperm ..	468·48 grains
Value of gas from 1 ton of coal in sperm ..	777·01 lb.
Illuminating power of gas in standard system (per London Argand)	19·52 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·50 per cent.
Carbonic acid (CO_2) in foul gas	2·50 per cent.
Carbonic oxide (CO) in foul gas	7·75 per cent.
Sulphur eliminated with volatile products	12·32 lb.
Liquid products—	
Tar per ton of coal	16·60 gallons
Ammoniacal liquor, per ton of coal ..	28·52 gallons
Strength of ammoniacal liquor	2·50 degs. Twadd.
Hygrometric water per ton of coal ..	16·30 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	10·68 per cent.
Solid products—	
Coke per ton of coal	1,265·15 lb.
Carbon in the coke	96·50 per cent.
Ash in the coke	3·50 per cent.
Sulphur in coke per ton of coal	2·68 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	13·25 lb.

Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 1,300 ft. of gas, and 1,535·5 lb. of sperm value per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas) this coal is equal to 58·88.

Analyst—Geo. R. Hislop, F.C.S., F.R.S.S.A.
Date of Analysis—January 31, 1902.

Notes.

LINLITHGOW.

GAVIN PAUL AND SONS LIMITED,

14, Torpichen Street, Edinburgh.

Colliery—RIDDOCHHILL, Main Seam, Riddochhill Pit.
Shipping Ports—On Forth (south side).
Rail—North British, Bathgate Station.
Canal—None.

Riddochhill Gas Coal.

Class of Coal—Gas.

A sample of this coal, representing the entire product of the seam, gave on examination the following results :—

The seam consists of semi-splint and bituminous coal, and in colour black with considerable lustre and brown streak. In fracture the splint portion separates into thin plates or foliations by fine deposits of vegetable charcoal, while the more bituminous portion possesses an irregular fracture and cubical cross-fracture, with deposits of calcic carbonate and ferric bisulphide; moderately cohesive and compact; on the fire it intumesces and agglomerates; colour of ash, pale yellow; thickness of seam, 60 in.; mean specific gravity, 1·280 (water 1·000); weight of 1 cubic foot, 80·0 lb.

		Per cent.
Chemical analysis—		
Volatile matter (containing 0·42 of sulphur)		33·83
Coke, consisting of—		
Carbon	55·69	
Sulphur	0·26	
Ash	2·72	
		58·67
Water expelled at 212 degs. Fahr. ..		7·50
		100·00

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	10,630 cubic feet
Gas from 1 cubic foot of the coal	379·64 cubic feet
Specific gravity of the gas	·496 (air 1·000)
Hydrocarbons absorbed by bromine ..	5·75 per cent.
Durability of 1 cubic foot by 5 in. jet flame	45 min. 9 sec.
Value of 1 cubic foot of gas in sperm ..	516·24 grains
Value of gas from 1 ton of coal in sperm ..	783·95 lb.
Illuminating power of gas in standard candles (per London Argand)	21·51 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·33 per cent.
Carbonic acid (CO_2) in foul gas	2·80 per cent.
Carbonic oxide (CO) in foul gas	6·25 per cent.
Sulphur eliminated with volatile products	9·39 lb.

Notes.

Linlithgow.

Riddochhill Gas Coal—*cont.*

Liquid products—	
Tar per ton of coal	13·80 gallons
Ammoniacal liquor per ton of coal ..	31·50 gallons
Strength of ammoniacal liquor	2·00 degs. Twadd.
Hygrometric water per ton of coal ..	16·80 gallons
Aqueous absorbent capacity of coal (determined by complete saturation) ..	10·80 per cent.
Solid products—	
Coke per ton of coal	1,314·20 lb.
Carbon in the coke	95·20 per cent.
Ash in the coke	4·80 per cent.
Sulphur in coke per ton of coal	5·84 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)..	12·98 lb.

While giving a good average yield of 21½-candle gas, this coal affords about 11¾ cwt. of first-class coke. It at same time contains a moderate percentage of sulphur, with about the average amount of water. Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 56·85.

Analyst—Geo. R. Hislop, F.C.S., F.R.S.S.A.

Date of Analysis—May 4, 1892.

Colliery—Boghead, Balbardie Seam, Boghead Pit.

Boghead Cannel Coal.

Class of Coal—Gas.

A sample of this coal, representing the entire product of the seam, gave on examination the following results:—

The coal is brownish-black, possesses moderate lustre and yellowish-brown streak; fracture irregular, inclining to slaty, with impressions of stigmaria; cross-fracture, large conchoidal and partly hackly, with slight deposits of calcic carbonate and ferric bisulphide in the natural partings; compact and cohesive; under distillation it partly and slightly intumesces; colour of ash, brownish-white; thickness of seam, 10 in.; mean specific gravity, 1·307 (water 1·000); weight of 1 cubic foot, 81·68 lb.

		Per cent.
Volatile matters (containing 0·44 of sulphur)		46·27
Coke, consisting of—		
Carbon	43·44	
Sulphur	0·13	
Ash	7·82	
		51·39
Water expelled at 212 degs. Fahr. ..		2·34
		100·00

Notes.

LINLITHGOW.

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	13,640 cubic feet
Gas from 1 cubic foot of the coal	497·37 cubic feet
Specific gravity of the gas	·617 (air 1·000)
Hydrocarbons absorbed by bromine ..	13·25 per cent.
Durability of 1 cubic foot by 5 in. jet flame	68 min. 18 sec.
Value of 1 cubic foot of gas in sperm ..	848·16 grains
Value of gas from 1 ton of coal in sperm ..	1,681·27 lb.
Illuminating power of gas in standard candles	35·34 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·25 per cent.
Carbonic acid (CO_2) in foul gas	2·20 per cent.
Carbonic oxide (CO) in foul gas	11·75 per cent.
Sulphur eliminated with volatile products	9·85 lb.
Liquid products—	
Tar per ton of coal	26·40 gallons
Ammoniacal liquor per ton of coal ..	9·20 gallons
Strength of ammoniacal liquor	3·75 degs. Twadd.
Hygrometric water per ton of coal ..	5·24 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	2·76 per cent.
Solid products—	
Coke per ton of coal	1,151·13 lb.
Carbon in the coke	84·80 per cent.
Ash in the coke	15·20 per cent.
Sulphur in coke, per ton of coal	2·91 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	11·65 lb.

This is a very rich cannel coal, and therefore one of great value for ordinary coal gas enrichment; under distillation it parts with its volatile products very speedily, yielding a large volume of 35·34-candle gas, and at same time affords 10·27 cwt. of coke of medium quality per ton. The foul gas, moreover, contains a very small percentage of impurities. Compared with Main Lesmahagow cannel coal represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas and 1,535·5 lb. of sperm value per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 110·96.

Analyst—Geo. R. Hislop, F.C.S., M.S.C.Ind., F.R.S.S.A.
Date of Analysis—March 12, 1900.

Notes.

STIRLINGSHIRE.

ROBT. ADDIE AND SONS' COLLIERIES LIMITED,

127, St. Vincent Street, Glasgow.

Colliery—HERBERTSHIRE, Steam and Smithy Seam, Nos. 2 and 3 Pits.

Shipping Ports—Glasgow, Greenock, Grangemouth, Bo'ness, Leith, and Dundee.

Rail—Caledonian, Denny Station.

Canal—None.

Herbertshire Navigation Coal.

Class of Coal—Steam.

		Per cent.
Proximate analysis—		
Volatile matters—		
Gas, tar, &c.	20·30	
Sulphur	0·30	
Water at 212 degs. Fahr. ..	1·28	
		21·88
Coke—		
Fixed carbon	73·71	
Sulphur	0·39	
Ash	4·02	
		78·12
		100·00

Coke per ton of coal, 1,750 lb., or 15 cwt. 2 qrs. 14 lb.

Specific gravity	1·293
Weight of 1 cubic foot	80½ lb.
Space required for stowage, per ton	41½ cubic feet

Composition of the coke, dry—	Per cent.
Carbonaceous or combustible matter	94·35
Sulphur	0·50
Ash	5·15
	100·00

Ultimate analysis—	Per cent.
Carbon	81·64
Hydrogen	4·99
Oxygen	6·04
Nitrogen	1·34
Sulphur	0·69
Ash	4·02
Water at 212 degs. Fahr. ..	1·28
	100·00

STIRLINGSHIRE.

Heating or calorific power absolute (water at 212 degs. Fahr., converted into steam by 1 lb. of coal)	14·90 lb.
Heating power, practical..	10·21 lb.

This is a steam coal of very fine quality, and is specially adapted for firing the boilers of steamships, as it possesses a very high heating power, while it gives comparatively little flame and scarcely any smoke. The sulphur and ash are both very moderate and in respect to these it compares favourably with the best description of Welsh and Newcastle coals. It is less friable than most coals of equally high heating power; it does not break or splinter in the fire, and it possesses the quality of coking or caking to a considerable extent.

Analyst—William Wallace, F.R.S.E., F.C.S., F.I.C.

Date of Analysis— . . . . . .

Herbertshire Smithy Coal.

Class of Coal—Manufacturing (?).

		Per cent.
Volatile matters—		
Gas, tar, &c.	21·40	
Sulphur	0·40	
Water	1·60	
		23·40
Coke—		
Fixed carbon	73·10	
Sulphur	0·40	
Ash	3·10	
		76·60
		100·00
Specific gravity		1·30
Weight of 1 cubic foot of the coal ..		81·25 lb.

This is a high-class smithy coal, and is extremely well adapted for its purpose. Its heating power is very high, it cakes well together, and makes an excellent hollow fire which is very lasting.

Analyst—R. R. Tatlock, F.R.S.E., F.C.S.

Date of Analysis—May 11, 1886.

Notes.

STIRLINGSHIRE.

ALLOA COAL COMPANY LIMITED,

Alloa.

Collieries—BANNOCKBURN and CARNOCK, Hartley and Wallsend Seams, Nos. 1, 2 and 3 Bannockburn, and Nos. 1 and 2 Carnock Pits.

Shipping Ports—Glasgow, Greenock, Grangemouth, Bo'ness, Leith, Dundee, Alloa.

Rail—Caledonian, Plean Station.

Canal—None.

Bannockburn Wallsend Drawing-room Coal.

Class of Coal—House.

The coal is black and of high lustre, while in fracture it is irregular, and in cross-fracture columnar and highly crystalline in structure, and of very uniform composition and density; mean specific gravity, 1·237 (water 1·000); weight of 1 cubic foot, 77·31 lb. It is moderately cohesive, but very compact and without a trace of lime or pyritic impurities.

	Per cent.
Volatile matters	29·10
Fixed carbon	66·50
Ash	2·10
Sulphur	0·05
Water	2·25
	100·00

Heating power of the coal as determined by Thomson's calorimeter:—1 lb. of the coal by perfect combustion evolves heat sufficient to convert 14·85 lb. of water from 212 degs. Fahr. into steam.

It contains exceptionally small percentages of ash, water and sulphur, possesses great heating power, durability and freedom from smoke, and is therefore an exceptionally fine drawing-room coal.

Analyst—Geo. R. Hislop, F.C.S., F.R.S.S.A.

Date of Analysis—December 22, 1894.

STIRLINGSHIRE.

Bannockburn Coking Gas Coal.

Class of Coal—Gas.

The coal is black, possesses high lustre and brown streak; fracture generally defined by laminæ of charcoal, while cross-fracture is angular and highly crystalline to semi-resinoid with trace only of calcium carbonate; moderately cohesive but compact; on the fire it largely intumesces and agglomerates; ash, pale brown and flocculent; thickness of seam, 25 in., and of very uniform density; mean specific gravity, 1·275 (water 1·000); weight of 1 cubic foot, 79·68 lb.

		Per cent.
Volatile matters (containing 0·33 of sulphur)		32·10
Coke, consisting of—		
Carbon	60·86	
Sulphur	0·21	
Ash	3·08	
		64·15
Water expelled at 212 degs. Fahr... ..		3·75
		100·00

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar.	11,632 cubic feet
Gas from 1 cubic foot of the coal	414·70 cubic feet
Specific gravity of the gas	·511 (air 1·000)
Hydrocarbons absorbed by bromine ..	6·00 per cent.
Durability of 1 cubic foot by 5 in. jet flame	43 minutes
Value of 1 cubic foot of gas in sperm ..	524·16 grains
Value of gas from 1 ton of coal in sperm..	871·00 lb.
Illuminating power of gas in standard candles, per London Argand	21·84 candles
Illuminating power of gas in standard candles, per Union jet	18 candles
Sulphuretted hydrogen (H_2S) in foul gas	·75 per cent.
Carbonic acid (CO_2) in foul gas	2·20 per cent.
Carbonic oxide (CO) in foul gas	5·25 per cent.
Sulphur eliminated with volatile products	7·55 lb.
Liquid products—	
Tar per ton of coal	12·12 gallons
Ammoniacal liquor per ton of coal ..	15·27 gallons
Strength of ammoniacal liquor	2·50 degs. Twadd.
Hygrometric water per ton of coal ..	8·40 gallons
Aqueous absorbent capacity of coal (determined by complete saturation) ..	4·25 per cent.

Notes.

STIRLINGSHIRE.

Bannockburn Coking Gas Coal—*cont.*

Solid products—

Coke per ton of coal	1,436·96 lb.
Carbon in the coke	95·20 per cent.
Ash in the coke	4·80 per cent.
Sulphur in coke per ton of coal	4·54 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)..	13·08 lb.

This is an excellent coal, and for the production of gas and coke it is without one detracting property. It yields a large volume of 21·84-candle gas, and affords 12·83 cwt. of remarkably good coke, while the percentages of water and sulphur in it are very moderate. Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas, and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products, and the cost of the purification of the gas), this coal is equal to 63·18 per cent.

Analyst—Geo. R. Hislop, F.C.S., F.R.S.S.A.

Date of Analysis—November 16, 1894.

BANKNOCK COAL COMPANY,

142, West Nile Street, Glasgow.

Colliery—BROOMRIGG, Splint Seam, Bonnyrigg Pit.

Shipping Ports—Bo'ness, Grangemouth, South Alloa.

Rail—North British and Caledonian, Bonnybridge Central Station.

Canal—Forth and Clyde Canal.

Banknock Gas Splint Coal.

Class of Coal—Gas.

A sample of this coal, representing the entire product of the seam, gave on examination the following results :—

The coal is black to brownish black, the seam consisting of 7 in. bituminous coal and 18 in. of hard splint, and fracture irregular to slaty, with deposits of charcoal; cross-fracture cubical and resinoid with considerable lustre to angular, with deposits of calcic carbonate and ferric bisulphide in the natural partings; moderately cohesive and compact; on the fire it intumesces and agglomerates; colour of ash, pale brown; mean specific gravity 1·272 (water, 1,000); weight of 1 cubic foot, 79·5 lb.

		Per cent.
Volatile matters (containing 0·39 of sulphur)		34·31
Coke, consisting of—		
Carbon	55·73	
Sulphur	0·23	
Ash	3·58	
		59·54
Water expelled at 212 degs. Fahr.		6·15
		100·00

Notes.

STIRLINGSHIRE.

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar.	10,930 cubic feet
Gas from 1 cubic foot of the coal	387·91 cubic feet
Specific gravity of the gas	·536 (air 1·000)
Hydrocarbons absorbed by bromine ..	6·30 per cent.
Durability of 1 cubic foot by 5 in. jet flame	43 min. 16 sec.
Value of 1 cubic foot of gas in sperm ..	517·20 grains
Value of gas from 1 ton of coal in sperm..	807·57 lb.
Illuminating power of gas in standard candles (per London Argand)	21·55 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·20 per cent.
Carbonic acid (CO_2) in foul gas	2·80 per cent.
Carbonic oxide (CO) in foul gas	9·00 per cent.
Sulphur eliminated with volatile products	8·73 lb.
Liquid products—	
Tar per ton of coal	14·20 gallons
Ammoniacal liquor per ton of coal ..	23·17 gallons
Strength of ammoniacal liquor	2·50 degs. Twadd.
Hygrometric water per ton of coal ..	13·77 gallons
Aqueous absorbent capacity of coal (determined by complete saturation) ..	8·09 per cent.
Solid products—	
Coke per ton of coal	1,333·69 lb.
Carbon in the coke	94·00 per cent.
Ash in the coke	6·00 per cent.
Sulphur in coke per ton of coal	5·15 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	12·91 lb.

This is an excellent splint for gas-making purposes, as in addition to yielding a considerable volume of 21·55 standard candles, it affords nearly 12 cwt. of excellent residual coke, while the foul gas contains a moderate percentage of impurities. Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas) this coal is equal to 58·24.

Analyst—Geo. R. Hislop, F.C.S., F.R.S.S.A.
Date of Analysis—March 14, 1896.

Notes.

STIRLINGSHIRE.

Colliery—BROOMRIGG, Jewel Seam, Broomrigg Pit.
Shipping Ports—Grangemouth, Bo'ness, South Alloa.
Rail—North British and Caledonian, Dennyloanhead Station.
Canal—Forth and Clyde Canal.

Banknock Jewel Coal.

Class of Coal—Gas and House.

A sample of this coal, representing the entire product of the seam, gave on examination the following results:—

The coal is black and of considerable lustre; fracture, chiefly irregular, but partly laminated with deposits of charcoal; cross-fracture, angular to cubical and largely resinoid, with slight deposits of calcic carbonate in the natural partings; moderately cohesive and compact; under distillation it intumesces and agglomerates; ash, pale brown and flocculent; thickness of seam, 42 in., and of very uniform density. Mean specific gravity 1·228 (water 1·000). Weight of 1 cubic foot, 76·75 lb.

		Per cent.
Volatile matters (containing 0·17 of sulphur)		32·79
Coke, consisting of—		
Carbon	58·11	
Sulphur	0·17	
Ash	2·18	
		60·46
Water expelled at 212 degs. Fahr. ..		6·75
		100·00

Gaseous products—

Gas per ton of coal at 60 degs. Fahr., and 30 in. bar.	10,750 cubic feet
Gas from 1 cubic foot of the coal	368·33 cubic feet
Specific gravity of the gas	·480 (air 1·000)
Hydrocarbons absorbed by bromine ..	4·60 per cent.
Durability of 1 cubic foot by 5 in. jet flame	42 min. 16 sec.
Value of 1 cubic foot of gas in sperm ..	437·28 grains
Value of gas from 1 ton of coal in sperm ..	671·53 lb.
Illuminating power of gas in standard candles (per London Argand)	18·22 candles
Sulphuretted hydrogen (H_2S) in foul gas	0·66 per cent.
Carbonic acid (CO_2) in foul gas	5·25 per cent.
Carbonic oxide (CO) in foul gas	6·75 per cent.
Sulphur eliminated with volatile products	5·82 lb.

STIRLINGSHIRE.

Notes.

Liquid products—

Tar per ton of coal	11·50 gallons
Ammoniacal liquor per ton of coal	27·20 gallons
Strength of ammoniacal liquor	3·25 degs. Twadd.
Hygrometric water per ton of coal ..	15·12 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	8·30 per cent.

Solid products—

Coke per ton of coal	1,354·30 lb.
Carbon in the coke	96·40 per cent.
Ash in the coke	3·60 per cent.
Sulphur in the coke per ton of coal ..	3·81 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	13·24 lb.

This is an excellent splint for gas-making purposes, as in addition to yielding a considerable volume of 21·55 standard candles, it affords nearly 12 cwt. of excellent residual coke, while the foul gas contains a moderate percentage of impurities. Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas and 1,535·5 lb. of sperm value per ton, and having regard also to the value of the secondary products, and the cost of the purification of the gas), this coal is equal to 48·34.

Analyst—Geo. R. Hislop, F.C.S., F.R.S.S.A.

Date of Analysis—May 12, 1898.

Colliery—BROOMRIGG, Kiltongue Seam, No. 3 Pit.

Shipping Ports—Bo'ness, Grangemouth, South Alloa.

Rail—K. and B. Railway, ... Station.

Canal—None.

Banknock Diamond Coking Coal.

Class of Coal—Coking.

A sample of this coal gave on examination the following results:— The coal is black, possesses high lustre and brown streak; fracture defined by deposits of charcoal; cross-fracture, angular and highly resinoid, with deposits of calcic carbonate and slight deposits of ferric bisulphide in the natural partings; moderately cohesive and compact; under distillation it intumesces and agglomerates; colour of ash, pale brown; thickness of seam, 28 in.; mean specific gravity, 1·280 (water 1·000); weight of 1 cubic foot, 80·0 lb.

Notes.

STIRLINGSHIRE.

Banknock Diamond Coking Coal—*cont.*

		Per cent.
Volatile matters (containing 0·35 of sulphur)		33·18
Coke, consisting of—		
Carbon	56·41	
Sulphur	0·17	
Ash	3·62	
		60·20
Water expelled at 212 degs. Fahr. ..		6·62
		100·00

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr. and 30 in. bar.	11,245 cubic feet
Gas from 1 cubic foot of the coal	401·60 cubic feet
Specific gravity of the gas	·496 (air 1·000)
Hydrocarbons absorbed by bromine ..	5·50 per cent.
Durability of 1 cubic foot by 5 in. jet flame	46 min. 18 sec.
Value of 1 cubic foot of gas in sperm ..	514·08 grains
Value of gas from 1 ton of coal in sperm ..	825·83 lb.
Illuminating power of gas in standard candles (per London Argand)	21·42 candles
Sulphuretted hydrogen (H_2S) in foul gas	1·50 per cent.
Carbonic acid (CO_2) in foul gas	3·50 per cent.
Carbonic oxide (CO) in foul gas	7·00 per cent.
Sulphur eliminated with volatile products	12·32 lb.
Liquid products—	
Tar per ton of coal	13·20 gallons
Ammoniacal liquor per ton of coal ..	24·57 gallons
Strength of ammoniacal liquor	2·50 degs. Twadd.
Hygrometric water per ton of coal .	14·82 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	9·80 per cent.
Solid products—	
Coke per ton of coal	1,348·48 lb.
Carbon in the coke	94·00 per cent.
Ash in the coke	6·00 per cent.
Sulphur in coke per ton of coal	3·80 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	12·91 lb.

This is an excellent gas and coking coal, yielding as it does of the former, a considerable volume of high quality; and of the latter, 12 cwt. per ton of the first class. The coal at same time contains moderate amounts of sulphur and water. Compared with the Main Lesmahagow

cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas, and 1,535·5 lb. of sperm value per ton, and having regard also to the value of the secondary products and the cost of the purification of the gas), this coal is equal to 58·21.

Analyst—Geo. R. Hislop, F.C.S., M.S.C.Ind., F.R.S.S.A.
Date of Analysis—February 6, 1904.

CARMUIR COAL COMPANY LIMITED,

21, Bothwell Street, Glasgow.

Colliery—CARMUIR, Gas Coal Coking Seam, No. 1 Pit.
Shipping Ports—Grangemouth, Bo'ness.
Rail—North British and Caledonian, Larbert Station.
Canal—None.

Carmuir Gas Coal.

Class of Coal—Gas.

A sample of this coal, representing the full section of the seam, gave on examination the following results :—

	Per cent.
Volatile matters	34·04
Coke	59·61
Water	6·35
Specific gravity of the coal	1·242 (water 1·000)
Weight of 1 cubic foot	77·62 lb.
Gas per ton of coal at 60 degs. Fahr. and 30 in. bar	11,810 cubic feet
Illuminating power of the gas	22·07 std. candles
Value of gas per ton in sperm	893·64 lb.
Coke per ton of coal	1,335·26 lb.
Carbon in the coke	97·00 per cent.
Ash in the coke	3·00 per cent.
Sulphuretted hydrogen in foul gas	1·25 per cent.
Carbonic acid in foul gas	4·50 per cent.
Carbonic oxide in foul gas	8·00 per cent.

This is an excellent coal for the production of gas and coke. It is a semi-splint and free coal of foliated fracture with deposits of charcoal pyrites and traces of lime carbonate. The coal affords 11·92 cwt. of remarkably pure coke per ton.

Analyst—Geo. R. Hislop, F.C.S., F.R.S.S.A.
Date of Analysis—February 7, 1898.

Notes.

STIRLINGSHIRE.

PLEAN COLLIERY COMPANY LIMITED,

65, Renfield Street, Glasgow.

Colliery—PLEAN, Bannockburn Seam, ... Pit.
Shipping Ports—Glasgow, Grangemouth, Bo'ness, Methil, Burntisland, Leith.
Rail—Caledonian, Plean Station.
Canal— . . . . . .

Plean Smithy Coal Nuts.

Class of Coal—Manufacturing (?)

	Per cent.	Lb. per ton
Volatile matters	21·83	488·99
Fixed carbon	73·45	1,645·28
Ash	1·90	42·56
Sulphur	0·54	12·10
Water, at 212 degs. Fahr.	2·28	51·07
	100·00	2,240·00

Specific gravity of the nuts .. .. 1·208 (water 1·000)
Weight of 1 cubic foot .. .. 7·55 lb.

Heating power of the nuts as determined by Thomson's calorimeter:—1 lb. of the coal nuts by perfect combustion will generate heat sufficient to convert 14·55 lb. of water from 212 degs. Fahr. into steam.

The nuts are remarkably clean and free from all foreign matters, and in size gauged between the meshes of a $\frac{5}{8}$ and $\frac{3}{8}$ screen, are cubical to rhomboidal in form, and possess considerable lustre; 95·82 per cent. of the coal being purely heat-giving matter, it possesses great heating energy. It contains a very moderate percentage of sulphur and water. In combustion it slightly agglomerates, and leaves a very small amount of brown ash.

Analyst—Geo. R. Hislop, F.C.S., F.R.S.S.A., F.I.Inst.
Date of Analysis—April 4, 1896.

Notes.

STIRLINGSHIRE.

Plean Gas and Coking Coal.

Class of Coal—Gas.

A sample of this coal, representing the entire product of the seam, gave on examination the following results:—

The coal is black, possesses high lustre, and brownish black streak. Fracture irregular and partly defined by laminæ of resinoid coal. Cross-fracture angular and highly crystalline to resinoid, and exhibiting numerous small bright planes. Moderately cohesive and compact, and of very uniform composition and density. Thickness of seam, 26 in.; mean specific gravity, 1·260 (water 1·000); weight of 1 cubic foot, 78·75 lb.

		Per cent.
Volatile matters (containing 0·24 of sulphur)		26·42
Coke, consisting of—		
Carbon	70·52	
Sulphur	0·14	
Ash	1·59	
		72·25
Water expelled at 212 degs. Fahr.		1·33
		100·00

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar	11,525 cubic feet
Gas from 1 cubic foot of the coal	405·18 cubic feet
Specific gravity of the gas	·482 (air 1·000)
Hydrocarbons absorbed by bromine ..	6·20 per cent.
Durability of 1 cubic foot by 5 in. jet flame	40 min. 16 sec.
Value of 1 cubic foot of gas in sperm ..	444·24 grains
Value of gas from 1 ton of coal in sperm ..	731·41 lb.
Illuminating power of gas in standard sperm candles (per London Argand) ..	18·51 candles
Sulphuretted hydrogen (H_2S) in foul gas	0·40 per cent.
Carbonic acid (CO_2) in foul gas	1·25 per cent.
Carbonic oxide (CO) in foul gas	7·00 per cent.
Sulphur eliminated with volatile products	5·39 lb.
Liquid products—	
Tar per ton of coal	10·20 gallons
Ammoniacal liquor per ton of coal ..	5·30 gallons
Strength of ammoniacal liquor	3·25 degs. Twadd.
Hygrometric water per ton of coal ..	2·97 gallons
Aqueous absorbent capacity of coal (determined by complete saturation) ..	1·55 per cent.

Notes.

STIRLINGSHIRE.

Plean Gas and Coking Coal—*cont.*

Solid products—

Coke per ton of coal	1,618·40 lb.
Carbon in the coke	97·80 per cent.
Ash in the coke	2·20 per cent.
Sulphur in coke per ton of coal	3·12 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	13·46

This is an exceptionally fine coal of its class; while yielding a large volume of 18½-candle gas, it affords 14·45 cwt. of remarkably pure coke per ton, and the percentage of impurities in the foul gas is about the lowest I have found in any coal. Compared with Main Lesmahagow cannel coal represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas, and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products, and the cost of the purification of the gas), this coal is equal to 58·44.

Analyst—Geo. R. Hislop, F.C.S., F.R.S.S.A., F.I.Inst.

Date of Analysis—August 28, 1895.

ARCHIBALD RUSSELL LIMITED,

68, Great Clyde Street, Glasgow.

Colliery—POLMAISE, Hartley Seam, Nos. 3 and 4 Pits.

Shipping Ports—Glasgow, Greenock, Ardrossan, Grangemouth, Bo'ness, Leith and the Fife ports.

Rail—Caledonian, Stirling Station.

Canal—None.

Polmaise Navigation Coal.

Class of Coal—Steam.

Specific gravity, 1·3034.

	As received. Per cent.	Dry. Per cent.
Carbon	84·26	85·46
Hydrogen	3·26	3·31
Nitrogen and oxygen	7·50	7·64
Sulphur	0·65	0·66
Ash	2·89	2·93
Water	1·44	—
	100·00	100·00

Notes.

Stirlingshire.

	As received. Per cent.		Dry. Per cent.
Volatile matter (including water)	22·12	..	—
Volatile matter (other than water)	20·68	..	20·98
Fixed carbon	74·99	..	76·09
Calorific value	7,926 calories		
Evaporative power (pounds water at 212 degs. Fahr. converted into steam by 1 lb. coal)	14·76		

The ash was light in colour and pulverulent. The residue after heating off the volatile matter was coherent but readily powdered.

The proportions of ash, sulphur and water are low; and the coal is of good quality for house, furnace, or steam purposes.

Analysts—Robertson and Gregory.
Date of Analysis—June 2, 1908.

Polmaise Anthracite Coal.

Class of Coal—Smokeless, Steam, Manufacturing.

Specific gravity	1·332
Moisture	2·75 per cent.
Composition of dry coal—	Per cent.
Carbon	87·30
Hydrogen	4·05
Sulphur	0·10
Oxygen and nitrogen	4·65
Mineral ash	3·90
	100·00
Volatile matter expelled at 1,000 degs. Cent. in one hour, reckoned on the dry coal ..	12·72 per cent.
Fixed carbon, reckoned on the dry coal ..	83·3 per cent.

Calorific power of dry coal—

(*a*) Burnt in a Berthelot-Mahler bomb calorimeter, with oxygen under pressure, the coal (dry coal) yielded 8·270 grm. Centigrade units per gram., or 14·880 B.T.U. per lb.

(*b*) If the steam produced during combustion were not condensed, the calorific value of the coal would be 8·048 grm. Centigrade units per gram., or 14·490 B.T.U. per lb.

The coal was a non-caking variety, of high calorific value, and it yielded a highly pulverulent coke. The ash was of a light buff colour, almost free from iron compounds. The coal contains a very minute quantity of arsenic, which is wholly "volatile." The quantity, however, is so small that it is scarcely possible to estimate it very accurately; it amounts to something between 1 part in 33,000, and 1 part in 50,000. The ash which remains when the coal is burnt is absolutely free from arsenic.

Analyst—William A. Bone, D.Sc., Ph.D.
Dates of Analyses—April 26, and October 27, 1904.

WALES.

Notes.

CARMARTHEN.

AMMANFORD COLLIERY COMPANY,

Ammanford, R.S.O.

Colliery—AMMANFORD, Little Vein Seam, Little Vein Slant.
Shipping Ports—Swansea, Llanelly, Port Talbot.
Rail—Great Western and L. and N. W., Ammanford Station.
Canal— . . . . . .

Little Vein Anthracite.

Class of Coal—Anthracite, Suction, Gas.

	Per cent.
Carbon	92·09
Hydrogen	3·54
Oxygen and nitrogen	1·96
Sulphur	0·94
Ash	1·47
	100·00
Moisture	0·39

Analyst—Norman Tate.
Date of Analysis— . . . . . .

BLAINA COLLIERY LIMITED,

2, Gloucester Place, Swansea.

Colliery—BLAINA, ... Seam, ... Pit.
Shipping Ports—Swansea, Llanelly.
Rail—Great Western, Pantyffynnon Station.
Canal— . . . . . .

Stanllyd Vein Anthracite Coal.

Class of Coal—Anthracite.

The coal dried at 100 degs. Cent. gave the following :—

	Per cent.
Volatile matter	5·09
Ash	1·15
Fixed carbonaceous matter ..	93·76
	100·00

Notes.

CARMARTHEN.

Stanllyd Vein Anthracite Coal—*cont.*

The composition of the dried sample was as follows :—

	Per cent.
Carbon	92·53
Hydrogen	3·61
Oxygen and nitrogen	1·96
Sulphur	0·75
Ash	1·15
	100·00

The sample was free from arsenic.

Analysts—Hy. A. Penrose and Co.

Date of Analysis—October 22, 1902.

CAEPONTBREN COLLIERY COMPANY LIMITED,

Kidwelly.

Colliery—CAEPONTBREN, Green Vein Seam, Caepontbren Pit.

Shipping Ports—Burry Port, Swansea.

Rail—Burry Port and Gwendraeth Valley, Great Western, Burry Port Station.

Canal—Nil.

Anthracite Coal.

Class of Coal—Anthracite.

	Per cent.
Carbon	92·06
Hydrogen	3·60
Oxygen and nitrogen	1·89
Sulphur	1·02
Ash	1·36

Analysts—Jas. S. Merry and Co.

Date of Analysis—November 22, 1904.

Notes.

CARMARTHEN.

CAERBRYN AND EMPIRE COLLIERIES LIMITED,

Burrows Chambers, Swansea.

Colliery—CAERBRYN, Stanllyd Seam, Caerbryn Pit.
Shipping Ports—Swansea, Llanelly, Port Talbot, Cardiff and Newport.
Rail—Great Western, Pantyffynon Station.
Canal—None.

Caerbryn Stanllyd Vein Anthracite Malting Coal.

Class of Coal—Anthracite.

The sample dried at 100 degs. Cent. gave the following results:—

	Per cent.
Volatile matter	4·90
Ash	1·02
Fixed carbonaceous matter ..	94·08
	100·00

The composition of the dry coal was as follows:—

	Per cent.
Carbon	92·70
Hydrogen	3·18
Oxygen and nitrogen	2·34
Sulphur	0·76
Ash	1·02
	100·00

The sulphur in the ash was 0·07 per cent., making total sulphur 0·83 per cent. The calorific power was 8,544 calories, equivalent to 15·91 lb. of water evaporated from and at 100 degs. Cent. per pound of coal (the water formed by the combustion of the coal, 0·28 lb., being condensed).

Analysts—Morgan and Seyler.

Date of Analysis—July 1, 1908.

Notes.

CARMARTHEN.

CARWAY LIMITED,

Pontyates.

Colliery—CARWAY, Big Vein Seam, Carway Slant Pit.
Shipping Ports—Swansea, Llanelly, Burry Port.
Rail—Great Western, Burry Port Station.
Canal—None.

Anthracite Coal.

Class of Coal—Anthracite.

Sample dried at 100 degs. Cent. gave :—

	Per cent.
Volatile matter	5·80
Ash	1·56
Fixed carbonaceous matter ..	92·64
	100·00

The composition of the dried coal was :—

	Per cent.
Carbon	91·42
Hydrogen	3·58
Oxygen and nitrogen	2·54
Sulphur	0·90
Ash	1·56
	100·00

Analysts—Morgan and Seyler.
Date of Analysis—April, 1905.

CAWDOR AND GARNANT COLLIERIES LIMITED,

13, Exchange Buildings, Swansea.

Colliery—GARNANT, Peacock Vein Seam, One Slant.
Shipping Ports—Swansea, Llanelly.
Rail—Great Western, Garnant Station.
Canal—None.

Garnant Peacock Vein Coal.

Class of Coal—Anthracite.

The coal dried at 100 degs. Cent. gave :—

	Per cent.
Volatile matter	6·00
Ash	1·75
Fixed carbonaceous matter ..	92·25
	100·00

CARMARTHEN.

Notes.

Garnant Peacock Vein Coal—*cont.*

The composition of the dried sample was as follows—

	Per cent.
Carbon	91·50
Hydrogen	3·67
Oxygen and nitrogen	2·23
Sulphur	0·85
Ash	1·75
	100·00

The sulphur in the ash was 0·07 per cent., making total sulphur 0·92 per cent. The calorific power was 8,624 calories, equivalent to 16·06 lb. of water evaporated from and at 100 degs. Cent. per pound of coal (the water formed by the combustion of the coal, 0·333 lb., being condensed).

Analyst—Clarence A. Seyler, B.Sc., F.I.C.
Date of Analysis—June 8, 1904.

Colliery—CAWDOR, Red Vein Seam, One Slant.

Red Vein Coal.

Class of Coal—Anthracite.

The sample as received contained—

	Per cent.
Moisture	1·29
Volatile matter	6·30
Fixed residue (including ash) ..	92·41
	100·00

The sample dried at 100 degs. Centigrade contained—

	Per cent.
Carbon	90·14
Hydrogen	3·88
Oxygen and nitrogen	2·47
Sulphur (combustible)	0·75
Ash	2·76
	100·00

Analysts—Wm. Morgan, Son and Seyler.
Date of Analysis—March 25, 1899.

Notes.

CARMARTHEN.

EMLYN ANTHRACITE COLLIERY LIMITED,

17, York Place, Swansea.

Colliery—EMLYN, Stanllydd Vein and Pumpquart Vein Seams, Pit and Slant . . . .

Shipping Ports—All South Wales Ports.

Rail—Great Western, Cross Hands Station.

Canal—None.

Emlyn Anthracite.

Class of Coal—Anthracite.

	Per cent.
Carbon	91·20
Hydrogen	2·95
Oxygen	2·46
Nitrogen	1·13
Sulphur	0·80
Ash	1·46
	100·00

3·59

Analyst—Bernard Dyer, D.Sc., F.I.C., F.C.S., etc.

Date of Analysis—May 31, 1905.

GELLYCEIDRIM COLLIERIES COMPANY LIMITED,

14, Cambrian Place, Swansea.

Colliery—GELLYCEIDRIM, "Big" Seam, Gellyceidrim Pit.

Shipping Ports—Swansea, Llanelly.

Rail—Great Western, L. and N. W., Garnant Station.

Canal—None.

Gellyceidrim Big Vein Malting Coal.

Class of Coal—Anthracite.

Chemical analysis—	Per cent.
Moisture	0·106
Carbon	93·578
Hydrogen	1·623
Nitrogen and oxygen	4·159
Sulphur	0·118
Ash	0·416
	100·000

Analyst—John Percy, M.D., F.R.S.

Date of Analysis—August, 1888.

Notes.

CARMARTHEN.

GREAT MOUNTAIN COLLIERIES COMPANY LIMITED,

Victoria Road, Llanelly.

Colliery—GREAT MOUNTAIN, Tumble, Llanelly and Mynydd Mawr Railway Seam, Great Mountain Pit.

Shipping Ports—Llanelly, Burry Port, Swansea.

Rail—Llanelly and Mynydd Mawr, Tumble Station.

Canal— . . . . . .

Great Mountain Anthracite Coal.

Class of Coal—Anthracite.

	Per cent.
Carbon	92·19
Hydrogen	3·76
Oxygen	1·81
Nitrogen	0·70
Sulphur	0·83
Ash	0·71
	100·00

The most careful tests prove the sample to be free from all traces of arsenic.

Analyst—W. Lincolne Sutton, F.I.C.

Date of Analysis—March 22, 1901.

LLANDEBIE COLLIERY COMPANY LIMITED,

2, Gloucester Place, Swansea.

Colliery—LLANDEBIE, Lower Pumpquart Seam, ... Pit.

Shipping Ports—Swansea, Llanelly.

Rail—Great Western, Tirydail Station.

Canal—None.

Llandebie Coal (Lower Pumpquart).

Class of Coal—Anthracite.

The composition of the dry coal was as follows :—

	Per cent.
Carbon	92·70
Hydrogen	3·31
Oxygen and nitrogen	2·29
Sulphur	0·70
Ash	1·00
	100·00

Notes.

CARMARTHEN.

The sulphur in the ash was 0·05 per cent., making total sulphur 0·75 per cent. The calorific power was 8,592 calories, equivalent to 16 lb. of water evaporated from and at 100 degs. Cent. per pound of coal (the water formed by the combustion of the coal, 0·30 lb., being condensed).

Analysts—Wm. Morgan and Seyler.

Date of Analysis—March 29, 1905.

I have made a most careful examination of the sample of coal marked "coal from Landebie Colliery," and I find that it is free from arsenic. This quality should render it an extremely desirable coal for malting purposes, and ought to command a ready sale amongst maltsters who make malt of a high class.

Analyst—John Heron, F.I.C., F.C.S.

Date of Analysis—March 13, 1905.

NEW CROSS HANDS COLLIERIES LIMITED,

Stafford Chambers, Llanelly.

Colliery— . . . . Seam, ... Pit.

Shipping Port— . . . .

Rail— . . . . Station.

Canal— . . . . . .

New Cross Hands Coal.

Class of Coal— . . . .

The sample dried at 100 degs. Cent. gave the following results:—

	Per cent.
Volatile matter	3·80
Fixed carbonaceous residue ..	95·44
Ash	0·76
	100·00

The composition of the dried coal was as follows:—

	Per cent.
Carbon	92·73
Hydrogen	3·37
Oxygen and nitrogen	2·69
Sulphur	0·45
Ash	0·76
	100·00

The above coal was free from arsenic.

Analysts—Wm. Morgan and Seyler.

Dates of Analysis—January 25, 1901, January 14, 1903.

CARMARTHEN.

Notes.

PONTYBEREM COLLIERIES COMPANY LIMITED,

1 and 2, Great Winchester Street, London, E.C.

Colliery—PONTYBEREM, Big Vein Seam, ... Pit.
Shipping Port—Burry Port.
Rail— . . . . Station.
Canal— . . . .

Pontyberem "Big Vein" Anthracite Cobbles.

Class of Coal—Anthracite.

Sample dried at 212 degs. Fahr.—	Per cent.
Fixed carbon	94·28
Volatile matter	4·06
Ash	0·84
Sulphur	0·82
	100·00

Moisture lost at 212 degs. Fahr. .. .. 1·83 per cent.

I also carefully examined the coal for the presence of arsenic, and found the fuel to be quite free from this element.

Analyst—Harry Silvester, B.Sc., F.I.C., F.C.S., etc.
Date of Analysis—1901.

Sample dried at 212 degs. Fahr.—	Per cent.
Fixed carbon	92·59
Volatile matter	4·72
Ash	1·84
Sulphur	0·85
	100·00

Moisture lost at 212 degs. Fahr. .. .. 2·28 per cent.
Arsenic.. .. .. *Nil.*

Analyst—Harry Silvester, B.Sc., F.I.C., etc.
Date of Analysis—June 11, 1906.

Notes.

CARMARTHEN.

Pontyberem Clynhebog Anthracite Coal.

Class of Coal—Anthracite.

	Per cent.
Fixed carbon	93·90
Volatile matter	4·23
Ash	1·22
Sulphur	0·65
Moisture	*Nil.*
	100·00

Moisture lost at 212 degs. Fahr. .. .. 2·74 per cent.

The coal was carefully examined for arsenic, and was found to be entirely free from this element.

Analyst—Harry Silvester, F.I.C., F.C.S., etc.
Date of Analysis—March 11, 1901.

Pontyberem "Glynhebog No. 1 Coal."

Class of Coal—Anthracite.

Sample dried at 212 degs. Fahr.—

	Per cent.
Fixed carbon	94·58
Volatile matter	3·74
Ash	1·12
Sulphur	0·56
	100·00

Moisture lost at 212 degs. Fahr ... .. 2·24 per cent.
Arsenic.. .. .. *Nil.*

Analyst—Harry Silvester, B.Sc., F.I.C., etc.
Date of Analysis—June 11, 1906.

Carmarthen.

Notes.

WESTERN VALLEYS ANTHRACITE COMPANY,

Gloster Chambers, Swansea.

Colliery—Tirydail, ... Seam, ... Pit.
Shipping Ports—Swansea, Llanelly, Burry Port.
Rail— . . . . Station.
Canal— . . . . . .

Tirydail Coal.

Class of Coal—Anthracite.

The sample dried at 100 degs. Cent. gave the following results—

	Per cent.
Volatile matter	5·30
Fixed carbonaceous residue ..	93·60
Ash	1·10
	100·00

The composition of the dried coal was as follows—

	Per cent.
Carbon	91·60
Hydrogen	3·61
Oxygen and nitrogen	3·25
Sulphur (combustible)	0·44
Ash	1·10
	100·00

The slight trace of arsenic is so infinitesimal that the coal can be declared as free.

Analysts—Wm. Morgan and Seyler.

Dates of Analysis—January 23, 1901; May 30, 1905.

Notes.

DENBIGH.

BROUGHTON AND PLAS POWER COAL COMPANY LIMITED,

Wrexham.

Colliery—PLAS POWER AND GATEWEN, Main and Four-foot Seams, Plas Power and Gatewen Pits.

Shipping Ports—Birkenhead, Ellesmere Port, Connah's Quay.

Rail—Great Central, Great Western, Plas Power, and Moss and Pentre Stations.

Canal—None.

Main and Four-foot Seams Coals.

Class of Coal—Gas, Steam, Manufacturing, House.

	Main. Per cent.	Four-feet Seam. Per cent.
Ash	2·45	3·20
Moisture	3·10	4·00
Carbon	77·77	78·18
Hydrogen	5·15	4·85
Oxygen (by difference)	8·65	7·53
Nitrogen	1·54	1·40
Sulphur	1·34	0·84
	100·00	100·00
	Per cent.	Per cent.
Fixed carbon (coke-ash)	57·25	57·10
Volatile matter	40·30	39·70
Coke	59·70	60·30

Analyst—A. N. Palmer, F.C.S.

Date of Analysis—April 6, 1905.

VAUXHALL COLLIERY COMPANY LIMITED,

Ruabon.

Colliery—VAUXHALL, Quaker Seam, ... Pit.

Shipping Ports—Birkenhead, Ellesmere Port.

Rail—Great Western, Ruabon Station.

Canal—None.

Quaker Coal.

Class of Coal—Gas, House.

A sample of this coal, representing the entire product of the seam, gave on examination the following results:—

Denbigh.

Notes.

Quaker coal—*cont.*

The coal is black, possesses considerable lustre and brown streak; fracture irregular, partly defined by laminæ of vegetable charcoal, while cross-fracture is angular and highly crystalline, with deposits of calcium carbonate and traces of ferric bisulphide in the natural partings; cohesive, compact, and of very uniform composition and density; mean specific gravity, 1·247 (water 1·000); weight of 1 cubic foot, 77·93 lb.

		Per cent.
Volatile matters (containing 0·32 of sulphur)		33·89
Coke, consisting of—		
Carbon	60·17	
Sulphur	0·18	
Ash	2·26	
		62·61
Water expelled at 212 degs. Fahr. ..		3·50
		100·00

Gaseous products—	
Gas per ton of coal at 60 degs. Fahr., and 30 in. bar.	12,125 cubic feet
Gas from 1 cubic foot of the coal	421·83 cubic feet
Specific gravity of the gas	·498 (air 1·000)
Hydrocarbons absorbed by bromine ..	5·80 per cent.
Durability of 1 cubic foot by 5in. jet flame	41 min. 9 sec.
Value of 1 cubic foot of gas in sperm ..	474·24 grains
Value of gas from 1 ton of coal in sperm ..	821·45 lb.
Illuminating power of gas in standard candles (per London Argand)	19·76 candles
Sulphuretted hydrogen (H_2S) in foul gas	0·75 per cent.
Carbonic acid (CO_2) in foul gas	2·50 per cent.
Carbonic oxide (CO) in foul gas	8·00 per cent.
Sulphur eliminated with volatile products	7·17 lb.
Liquid products—	
Tar per ton of coal	14·50 gallons
Ammoniacal liquor per ton of coal ..	14·12 gallons
Strength of ammoniacal liquor	2·75 degs. Twadd.
Hygrometric water per ton of coal ..	7·84 gallons
Aqueous absorbent capacity of coal (determined by complete saturation)	5·10 per cent.
Solid products—	
Coke per ton of coal	1,402·46 lb.
Carbon in the coke	96·40 per cent.
Ash in the coke	3·60 per cent.
Sulphur in coke per ton of coal	4·03 lb.
Heating power of 1 lb. of coke (water from boiling point into steam)	13·24 lb.

Notes.

DENBIGH.

Quaker Coal—*cont.*

This coal yields a large volume of comparatively rich gas, affords 12·52 cwt. of first-class coke, and is in every other respect a first-class gas and coking coal. In distillation it parts with its volatile constituents speedily, and the foul gas contains an unusually small percentage of impurities. Compared with Main Lesmahagow cannel coal, represented by 100 (calculated on the basis of a production of 13,000 cubic feet of gas, and 1,535·5 lb. of sperm per ton, and having regard also to the value of the secondary products, and the cost of the purification of the gas), this coal is equal to 63·18.

Analyst—Geo. R. Hislop, F.C.S., F.I.Inst., F.R.S.S.A.

Date of Analysis—April 7, 1894.

Notes.

FLINTSHIRE.

HEATHS DEE COLLIERIES LIMITED,

Llanerch-y-mor, Holywell.

Colliery—LLANERCHYMOR, ... Seam, Llanerchymor Pit

Shipping Ports—Llanerchymor Wharf, on the Dee.

Rail—Great Western, Llanerchymor Siding, Holywell Station.

Canal—None.

Heaths Dee Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

	Per cent.
Coke—	
Ash	3·920
Fixed carbon	60·705
Volatile matter—	
Moisture	5·615
Volatile combustible matter ..	29·760
	100·000
Sulphur	0·623

Calorific power determined by oxygen calorimeter, 8,952.

Analysts—Thompson and Middleton.

Date of Analysis— . . . . . .

G. WATKINSON AND SONS LIMITED,

Buckley, Chester.

Colliery—BUCKLEY, ... Seam, ... Pit.

Shipping Ports—Connah's Quay, Birkenhead, Ellesmere Port.

Rail—Great Central, Buckley Station.

Canal— . . . . . .

Buckley Steam Coal.

Class of Coal—Steam.

	Per cent.
Volatile matters other than sulphur and water)	35·70
Fixed carbon	53·25
Sulphur	1·37
Ash	3·62
Water	6·06
	100·00

Composition of ash—	Per cent.
Silica	1·12
Lime	0·40
Phosphorus	0·012

Analyst—A. Norman Tait and Co.

Date of Analysis—February 1, 1905.

Notes.

GLAMORGAN.

BLAENCLYDACH COLLIERY COMPANY LIMITED,

9, Mount Stuart Square, Cardiff.

Colliery—BLAENCLYDACH, Abergorky Seam, Abergorky Pit.
Shipping Ports—Cardiff, Barry, Newport, Port Talbot, Swansea.
Rail—Taff Vale, Blaenclydach (Trealaw) Station.
Canal— . . . . . .

Blaenclydach Coal.

Class of Coal—Steam, Manufacturing.

	Per cent.
Volatile matter	19·37
Carbon	75·73
Moisture	1·20
Ash	3·01
Sulphur	0·69
	100·00

Analyst—F. G. Treharne.
Date of Analysis—May, 1905.

CAERBRYN AND EMPIRE COLLIERIES LIMITED,

Burrows Chambers, Swansea.

Colliery—EMPIRE, No. 2 Rhondda Seam, Empire Pit.
Shipping Ports—Port Talbot, Swansea, Cardiff, Penarth, Barry, and Newport.
Rail—Great Western, Glyn Neath Station.
Canal—None.

Empire Large Steam Coal.

Class of Coal—Steam.

The dry coal gave the following results :—

	Per cent.
Volatile matter	14·30
Ash	3·15
Fixed carbonaceous matter ..	82·55
	100·00

The calorific power was 8,381 calories (15,085 B.T.U.), equivalent to 15·60 lb. of water evaporated from and at 100 degs. Cent. per pound of coal.

Analysts—Morgan and Seyler.
Date of Analysis—July 1, 1908.

GLAMORGAN.

Notes.

CAMBRIAN COLLIERIES LIMITED,

Bute Docks, Cardiff.

Colliery— . . . . Seam, ... Pit.

Shipping Ports—Cardiff, Penarth, Barry, Port Talbot.

Rail—Great Western, Barry, Taff Vale, ... Station.

Canal—None.

Cambrian Navigation Steam Coal.

Class of Coal—Steam.

	Per cent.
Carbon	90·06
Hydrogen	5·16
Oxygen	2·79
Nitrogen	0·79
Sulphur	0·58
Ash	0·62
	100·00

The analysis was made on the coal dried at 212 degs. Fahr. The coal contained, as received, moisture, at 212 degs. Fahr., 0·76 per cent. The chemical composition of the above coal is very good; it contains a high percentage of carbon, with a very small quantity of sulphur and ash.

Analyst—Edward Riley, F.C.S.

Date of Analysis— . . . .

CARDIFF HOUSE AND STEAM COAL COMPANY LIMITED,

24, Bute Docks, Cardiff.

Colliery—TY-GWYN-BACH, Two and a-half Feet Seam, Level Pit.

Shipping Port—None.

Rail—Great Western and Port Talbot, Nantyffyllon Station.

Canal—None.

Ty-Gwyn-Bach Small Coal.

Class of Coal—House and Steam (?)

	Per cent.
Volatile matter	17·250
Fixed carbon	79·550
Ash..	3·200

This is an excellent coal for coking, very clean, and of strong structure.

Analyst—Arthur R. Roberts.

Date of Analysis—April 15, 1902.

Notes.

GLAMORGAN.

CLYNE VALLEY COLLIERY COMPANY,

58, Wind Street, Swansea.

Colliery—CLYNE Valley, Yankee Seam, ... Pit.
Shipping Ports—Swansea, Port Talbot, etc.
Rail—L. and N. W., Mumbles Road Station.
Canal—None.

Yankee Seam Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

The coal dried at 100 degs. Cent. gave the following results:—

	Per cent.
Volatile matter	30·10
Ash	2·30
Fixed carbonaceous matter ..	67·60
	100·00

	Per cent.
Carbon	85·10
Hydrogen	5·38
Oxygen and nitrogen	6·09
Sulphur	1·13
Ash	2·30
	100·00

The calorific power was 8,520 calories, equivalent to 15·86 lb. of water evaporated from and at 100 degs. Cent. per pound of coal, or deducting the water formed by combustion (0·48 lb.) 15·38 lb. net. The coal caked well and yielded a metallic coke considerably swollen, and would be an excellent smith's or gas coal. It is an "ortho-bituminous," or true bituminous coal, having a high yield of coke and good caking power.

Analysts—Wm. Morgan and Seyler.

Date of Analysis—December 11, 1903.

Colliery—CLYNE VALLEY, Four-foot Seam, ... Pit.

Four-foot Seam Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

The coal dried at 100 degs. Cent. gave the following results:—

	Per cent.
Volatile matter	29·50
Ash	2·64
Fixed carbonaceous matter ..	67·86
	100·00

Notes.

GLAMORGAN.

	Per cent.
Carbon	85·40
Hydrogen	5·16
Oxygen and nitrogen	5·62
Sulphur	1·18
Ash	2·64
	100·00

The calorific power was 8,504 calories, equivalent to 15·83 lb. of water evaporated from and at 100 degs. Cent. per pound of coal, or deducting the water formed by combustion (0·46 lb.) 15·37 lb. net. The caking power was considerable and the coke metallic but not very swollen. It is an "ortho-bituminous," or true bituminous coal, having a high yield of coke and good caking power, and would form an excellent coal for coke or gasmaking, or for smith's work.

Analysts—Wm. Morgan and Seyler.
Date of Analysis—December 11, 1903.

Colliery—CLYNE VALLEY, Three-foot Seam, ... Pit.

Three-foot Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

The coal dried at 100 degs. Cent. gave the following results :—

	Per cent.
Volatile matter	29·90
Ash	4·34
Fixed carbonaceous matter ..	65·76
	100·00

	Per cent.
Carbon	82·70
Hydrogen	5·21
Oxygen and nitrogen	6·91
Sulphur	0·84
Ash	4·34
	100·00

The calorific power was 8,240 calories, equivalent to 15·34 lb. of water evaporated from and at 100 degs. Cent. per pound of coal, or deducting the water formed by combustion (0·47 lb.) 14·87 lb. net. The coal caked well and yielded a metallic compact coke. It is of the "ortho-bituminous," or true bituminous class, having a high yield of coke and good caking power, and would form an excellent coal for coke or gasmaking, or smith's work.

Analysts—Wm. Morgan and Seyler.
Date of Analysis—December 11, 1903.

Notes.

GLAMORGAN.

Colliery—CLYNE VALLEY, Six-foot Seam, ... Pit.

Six-foot Seam Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

The coal dried at 100 degs. Cent. gave the following results—

	Per cent.
Volatile matter	30·22
Ash	1·85

Analysts—Wm. Morgan and Seyler.

Date of Analysis—February 13, 1906.

Colliery—CLYNE VALLEY, Five-foot Seam, ... Pit.

Five-foot Seam Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

The coal dried at 100 degs. Cent. gave the following results—

	Per cent.
Volatile matter	30·37
Ash	1·75

Analyst—Wm. Morgan and Seyler.

Date of Analysis—February 13, 1906.

CORY BROTHERS AND CO. LIMITED,

Bute Docks, Cardiff.

Colliery— . . . . Seam, ... Pit.

Shipping Ports—Cardiff, Penarth, Barry, Newport, Swansea, and Port Talbot.

Rail— . . . . Station.

Canal— . . . . . .

Navigation Steam Coal.

Class of Coal—Steam.

	Composition per cent.	Composition per cent. dried at 212 degs. F.	Composition per cent. exclusive of Sulphur, Ash and Water.
Carbon	88·35	89·09	91·68
Hydrogen	4·71	4·75	4·89
Oxygen	2·12	2·14	2·20
Nitrogen	1·19	1·20	1·23
Sulphur	1·07	1·08	—
Ash	1·73	1·74	—
Water	0·83	—	—
	100·00	100·00	100·00

GLAMORGAN.

Notes.

	Per cent.
Fixed carbon	86·52
Volatile matter, other than sulphur and water	9·85
Ash, sulphur, and water ..	3·63
	100·00

Specific gravity, 1·286, water at 60 degs. Fahr. being 1·000; colour of ash, greyish red; coke, 88·25 per cent., fairly hard and compact, but dull in appearance; total heat units (Favre and Silbermann), 8,667; calorific power (Thompson), 7,738 calories; evaporative power (weight of water evaporated per pound of coal), as determined by Thompson's calorimeter, 14·41 lb. of water.

Analyst—Thomas Hughes, F.I.C., F.C.S.
Date of Analysis—April 18, 1903.

Glyn Castle Anthracite Coal.

Class of Coal—Anthracite.

	Per cent.
Carbon	91·67
Hydrogen	3·93
Oxygen	1·87
Nitrogen	0·44
Sulphur	0·77
Ash	1·32
	100·00

Analyst—Thomas Hughes.
Date of Analysis—April 29, 1892.

"Cory's Merthyr" Large Steam Coal.

Class of Coal—Steam.

	Composition. Per cent.		Composition per cent., exclusive of Sulphur, Ash, and Water.
Carbon	89·07	..	91·83
Hydrogen	4·42	..	4·55
Oxygen	2·40	..	2·47
Nitrogen	1·11	..	1·15
Sulphur	0·71	..	—
Ash	1·86	..	—
Water	0·43	..	—
	100·00	..	100·00

Notes.

GLAMORGAN.

"Cory's Merthyr" Large Steam Coal—*cont.*

	Per cent.
Fixed carbon	84·64
Volatile matter other than sulphur and water	12·36
Sulphur, ash and water	3·00
	100·00

Nature of coal, semi-bituminous. Coke 86·5 per cent., very firm and compact, and of a dark steel grey lustre. Specific gravity 1·313, water at 60 degs. Fahr. being 1·000; colour of ash, pinkish. Calorific power or total heat units (Favre and Silbermann) to which the coal is equivalent, 8·616; evaporative power by Thompson's calorimeter 14·02 lb. of water per pound of coal, or 7·529 calories.

Analyst—Thomas Hughes, F.I.C., F.C.S.
Date of Analysis—September 11, 1891.

"Cory's Aberdare Merthyr" Large Steam Coal.

Class of Coal—Steam.

	Composition per cent.		Composition per cent. exclusive of Sulphur, Ash and Water.
Carbon	86·01	..	91·25
Hydrogen	4·65	..	4·93
Oxygen	2·61	..	2·77
Nitrogen	0·99	..	1·05
Sulphur	1·56	..	—
Ash	2·93	..	—
Water	1·25	..	—
	100·00	..	100·00

	Per cent.
Fixed carbon	76·07
Volatile matter (other than sulphur and water)	18·19
Ash, sulphur and water	5·74
	100·00

Specific gravity 1·292, water at 60 degs. Fahr. being 1·000; colour of ash, brownish; coke 79 per cent., hard and compact, and of a steel grey lustre; total heat units (Favre and Silbermann), 8,441; calorific power (Thompson), 7,856; evaporative power (Thompson), 14·63 lb. of water per pound of coal.

Analyst—Thos. Hughes, F.I.C., F.C.S.
Date of Analysis—December 21, 1892.

GLAMORGAN.

Notes.

Rheola Merthyr Steam Coal.

Class of Coal—Steam.

	Composition per cent.		Composition per cent. exclusive of Sulphur, Ash and Water.
Carbon	87·65	..	92·36
Hydrogen	4·05	..	4·27
Oxygen	2·21	..	2·33
Nitrogen	0·99	..	1·04
Sulphur	1·01	..	—
Ash	2·78	..	—
Water	1·31	..	—
	100·00	..	100·00

	Per cent.
Fixed carbon	86·92
Volatile matter other than sulphur and water	7·98
Sulphur, ash and water	5·10
	100·00

Nature of coal, semi-bituminous; colour of ash, greyish; specific gravity of coal 1·341, water at 60 degs. Fahr. being 1·000; total heat units (Favre and Silbermann) to which the coal is equivalent, 8,381; calorific power, determined by Berthier's method. 7,960 calories.

Analyst—Thomas Hughes, F.I.C., F.C.S.
Date of Analysis—September 12, 1895.

Notes.

GLAMORGAN.

THE COYTRAHEN PARK COLLIERY COMPANY,

Swansea.

Colliery—COYTRAHEN PARK, Rock Fawr Seam, Coytrahen Park Slant.
Shipping Ports—Swansea, Cardiff, Barry, Port Talbot and Briton Ferry.
Rail—Great Western, Tondû Station.
Canal—None.

Coytrahen Park Through Coal.

Class of Coal—House and Steam.

The coal was dried at 212 degs. Fahr.

	Per cent.
Volatile matter	33·20
Fixed carbon	62·70
Sulphur	0·95
Ash	4·10

Calorific power, 7,637 calories (Thompson's).

Analysts—H. A. Penrose & Co.
Date of Analysis—September 16, 1908.

CWMAMMAN COAL COMPANY LIMITED.

Aberdare.

Colliery—CWMAMMAN, ... Seam, Cwmamman Pit.
Shipping Ports—Cardiff, Barry, Newport, Swansea, and Port Talbot.
Rail—Great Western, Taff Vale, Rhymney, Dare Junction (G.W.), Middle Duffryn (T.V. and R.) Stations.
Canal— . . . .

Cwmamman Steam Coal.

Class of Coal—Smokeless Steam.

	Per cent.
Carbon	91·11
Hydrogen	3·95
Oxygen	1·55
Nitrogen	·90
Sulphur	·52
Ash	1·97
	100·00

Analyst—I. W. Thomas.
Date of Analysis— . . . .

GLAMORGAN.

Notes.

Cwmamman Smokeless Steam Coal.

Class of Coal—Smokeless Steam.

	Per cent.
Moisture	0·70
Volatile hydrocarbon, &c. ..	11·76
Fixed carbon	85·57
Ash	1·97
	100·00
Yield of coke	87·54

Calculated from Berthier's test, 1 lb. of this coal possesses calorific power to convert into steam 13·93 lb. of water at 100 degs. Cent., or within 0·78 lb. as much as 1 lb. of pure carbon does.

Analyst—E. W. T. Jones.
Date of Analysis— . . . .

Colliery—FFORCHWEN, ... Seam, Fforchwen Pit.

Fforchwen Smokeless Steam Coal.

Class of Coal—Smokeless Steam.

	Per cent.
Fixed carbon	85·74
Volatile and combustible matter	10·34
Sulphur	0·92
Ash	2·30
Moisture	0·70
	100·00

Calorific power:—1 lb. of coal converts 12·47 lb. water into steam at a temperature of 212 degs. Fahr.

Analyst—J. Stewart Remington.
Date of Analysis—May, 1905.

Notes.

GLAMORGAN.

DILLWYN COLLIERY COMPANY LIMITED,

Exchange, Cardiff.

Colliery—DILLWYN, Red Vein Seam, ... Pit.
Shipping Ports—Swansea, Port Talbot, Briton Ferry.
Rail—Neath and Brecon, Seven Sisters Station.
Canal—None.

Dillwyn Coal.

Class of Coal—Anthracite.

	Sample after drying. Per cent.	In sample as received. Per cent.
Carbon	88·79	87·24
Hydrogen	3·30	3·25
Nitrogen	0·71	0·70
Oxygen	2·10	2·07
Sulphur	1·18	1·16
Ash	3·92	3·83
Water	—	1·75
	100·00	100·00

Calorific power: Pounds of water evaporated from 212 degs. Fahr. by the burning of 1 lb. of the coal as determined in

Lord Kelvin's apparatus	15·4 lb.
Calories (French units)	8,200 units
Volatile matters	10·40 per cent.

Analyst—J. S. Rowlands.
Date of Analysis—May 13, 1900.

GLANMWRWG COLLIERY COMPANY LIMITED,

Llangennech.

Colliery—GLANMWRWG, ... Seam, ... Pit.
Shipping Ports—Swansea, Llanelly, Port Talbot, Briton Ferry.
Rail—Great Western, Llangennech Station.
Canal—None.

Glanmwrwg Coal.

Class of Coal—Steam.

	Per cent.
Fixed carbon	79·54
Volatile matter	14·52
Moisture (water)	1·56
Ash	4·38
	100·00

Analyst—F. G. Treharne.
Date of Analysis—1905.

Notes.

GLAMORGAN.

GRAHAM'S NAVIGATION (MERTHYR) COLLIERIES LIMITED,
Cardiff.

Colliery—GRAHAM'S NAVIGATION (MERTHYR), Steam Coal Seams, Graham's Navigation Pit.

Shipping Ports—Cardiff, Newport, Barry and Penarth.

Rail—L. and N. W., Tredegar Station.

Canal—None.

Graham's Navigation (Merthyr) Steam Coal.

Class of Coal—Steam.

	Per cent.
Fixed carbon	78·63
Volatile matter	17·16
Ash	3·21
Water (moisture)	1·00
	100·00
Percentage of sulphur	0·68

Its elemental composition is as follows—

Carbon	86·33
Hydrogen	4·56
Oxygen	3·07
Nitrogen	1·15
Sulphur	0·68
Ash	3·21
Moisture	1·00
	100·00

Its calorific value by Thompson's calorimeter is 7,761 calories.

Analyst—F. G. Treharne.

Date of Analysis—July 12, 1904.

Notes.

GLAMORGAN.

GREAT WESTERN COLLIERY COMPANY LIMITED,

The Exchange, Bristol.

Colliery—RHONDDA VALLEY, ... Seam, Various Pits.
Shipping Ports—Cardiff, Penarth, Barry, Newport, Port Talbot, Swansea.
Rail—T.V.R., Pontypridd Station.
Canal— . . . .

Navigation Smokeless Steam Coal.

Class of Coal—Smokeless Steam.

	Per cent.
Ultimate analysis—	
Carbon	86·48
Hydrogen	4·04
Oxygen	3·62
Nitrogen	0·88
Sulphur	0·70
Ash	3·04
Moisture	1·24
	100·00
Percentage composition—	
Moisture	1·24
Volatile matter	18·53
Ash	3·04
Carbon	77·99
	100·00

Calories by Thomson's calorimeter, 7,755; evaporative power by Thomson's calorimeter, 14·44 lb. of water at 100 degs. Cent. per pound of coal.

Analyst—F. G. Treharne.

Date of Analysis— . . . .

GLAMORGAN.

Notes.

Colliery— . . . . Seam, Maritime Level, Penrhiw, and No. 3 Pits.

Forest Coal.

Class of Coal—Bituminous.

	Per cent.
Carbon	83·26
Hydrogen	5·18
Oxygen	6·72
Nitrogen	1·23
Sulphur	0·69
Ash	1·76
Moisture	1·16
	100·00

Analyst—F. G. Treharne.
Date of Analysis— . . . .

Colliery—PENRHIW, ... Seam, ... Pit.

No. 3 Rhondda Coal.

Class of Coal—Bituminous.

Ultimate analysis—	Per cent.
Carbon	84·93
Hydrogen	5·11
Oxygen	4·91
Nitrogen	1·08
Sulphur	0·74
Ash	1·64
Moisture	1·59
	100·00

Percentage composition—	Per cent.
Moisture	1·59
Volatile matter	24·58
Ash	1·64
Fixed carbon	72·19
	100·00

Analyst—F. G. Treharne.
Date of Analysis— . . . .

Notes.

GLAMORGAN.

HILL'S PLYMOUTH COMPANY LIMITED,

Merthyr Tydvil.

Colliery—HILL'S PLYMOUTH, Upper Four-feet and Nine-feet Seams, South Pits.

Shipping Ports—Cardiff, Penarth, Barry, Newport, Swansea, Port Talbot.

Rail—Taff Vale, Pentrebach Station.

Canal—None.

Hill's Plymouth Merthyr Smokeless Steam Coal.

Class of Coal—Smokeless Steam.

	Per cent.
Carbon	86·98
Hydrogen	4·39
Oxygen	1·72
Nitrogen	1·01
Sulphur	0·86
Ash	3·97
Moisture	1·07
	100·00

Total heat units (Favre and Silbermann), 8,439 calories.

Analyst—F. G. Treharne.

Date of Analysis—October 27, 1900.

W. W. HOLMES AND CO.,

2, Gloucester Place, Swansea.

Colliery—KILLAN, Penclawdd and Penlan Seams, ... Pit.

Shipping Port—Swansea.

Rail—L. and N. W., Dunvant Station.

Canal—None.

Killan Coal.

Class of Coal—Gas, Manufacturing, House.

	Per cent.
Volatile matter	33·30
Ash	3·22
Moisture	1·50

Analyst— . . . .

Date of Analysis—May 5, 1903.

GLAMORGAN. *Notes.*

LYNCH COLLIERY COMPANY,

Llanmorlais, Penclawdd.

Colliery—LYNCH, Lynch Seam, Drift and Slant Pit.
Shipping Ports—Swansea.
Rail—L. and N. W., Llanmorlais Station.
Canal—None.

Lynch Coal.

Class of Coal—House.

	Per cent.
Volatile matter	26·30
Ash	2·35
Fixed carbonaceous matter ..	71·35
	100·00
Coke..	73·70

The total sulphur in the coal was 1·58 per cent. on the dry coal. The sample as received contained 1·20 per cent. moisture. The coke was grey, metallic and considerably swollen.

Analysts—Wm. Morgan and Seyler.
Date of Analysis— . . . . . .

MERTHYR LLANTWIT COLLIERY COMPANY,

Burrows Chambers, Swansea.

Colliery—MERTHYR LLANTWIT, Wenalt Seam, ... Pit.
Shipping Ports—Swansea, Port Talbot.
Rail—Great Western, Port Talbot and Briton Ferry Stations.
Canal—None.

Merthyr Llantwit Coal.

Class of Coal—Steam, Manufacturing, House.

	Per cent.
Fixed carbon	73·72
Volatile matter	17·72
Ash	7·75
Moisture	0·81
	100·00
Sulphur	2·41

Analysts—H. A. Penrose and Co.
Date of Analysis— . . . . . .

Notes.

GLAMORGAN.

NAVAL COLLIERY COMPANY (1897) LIMITED,

Cardiff.

Colliery— . . . . , Naval Seam, Pandy, Ely and Nantgwyn Pits.

Shipping Ports—Cardiff, Barry, Newport, Port Talbot.

Rail—Taff Vale and Great Western, Dinas and Penygraig Stations.

Canal—None.

	Pure coal from Naval Seam. Per cent.	Sample taken during and throughout a shipment. Per cent.
Fixed carbon	80·16	78·83
Volatile matter	16·37	16·64
Ash	2·46	3·49
Water (moisture)	1·01	1·04
	100·00	100·00
Percentage of sulphur	0·63	0·68
Complete ultimate analysis—	Per cent.	Per cent.
Carbon	88·14	87·04
Hydrogen	4·58	4·55
Oxygen	2·11	2·19
Nitrogen	1·07	1·01
Sulphur	0·63	0·68
Ash	2·46	3·49
Moisture	1·01	1·04
	100·00	100·00
Calorific value by Thompson's calorimeter	7,989 calories	7,929 calories
Evaporative power by Thompson's calorimeter (water evaporated at 212 degs. Fahr. per pound of coal)	14·87 lb.	14·74 lb.
Its total heat units (Favre and Silbermann) value is	8,607 calories	8,444 calories

Its specific gravity, water at 60 degs. Fahr. being 1·000, is 1·311; the ash was tested for fusibility and found to belong to the non-fusible type; the coal burns freely, and slightly agglomerates in the fire.

Analyst—F. Gwilym Treharne.

Dates of Analysis—January 30 and February 1, 1904.

GLAMORGAN.

Notes.

NEW BLAENGARW COLLIERY COMPANY LIMITED,

2, Cambrian Place, Swansea.

Colliery—NEW BLAENGARW, Victoria Seam, ... Pit.
Shipping Ports—Port Talbot, Swansea, Barry, Cardiff.
Rail—Great Western, Blaengarw Station.
Canal—None.

Blaengarw Coal.

Class of Coal—Coking, Smiths' and Manufacturing.

	Per cent.
Volatile matter	23
Carbon	74
Ash	3

Analysts—H. A. Penrose and Co.
Date of Analysis— . . . . . .

Blaengarw Victoria Large Coal.

Class of Coal—Coking, Smiths' and Manufacturing.

	Per cent.
Volatile matter	23
Carbon	74
Ash	3

Analysts—J. S. Merry and Co.
Date of Analysis—July 25, 1906.

Notes.

GLAMORGAN.

PHILLIPS AND MOGFORD,

Pontypridd.

Colliery—PWLLGWAUN, Forest-fach Seam, Pwllgwaun Pit.
Shipping Port—Cardiff.
Rail—Taff Vale, Pontypridd Station.
Canal—Glamorganshire.

Pwllgwaun Coal.

Class of Coal—House, Gas.

The sample (through coal) was examined for gas purposes, with the following results:—

	Per cent.
Fixed products	71·80
Volatile products..	28·20
Sulphur in coal	3·30
Ash in coal..	2·02
	100·00

The quantity of purified gas per ton (2,240 lb.) at 30 in. bar. and 60 degs. Fahr. was 9,920 cubic feet. The coal is low in ash, the coke is bright and coherent, and the yield of gas is good. Coke, 71·80 per cent.

Analyst—J. S. Rowland.
Date of Analysis—June 5, 1895.

PHŒNIX MERTHYR COAL COMPANY LIMITED,

50, Mount Stuart Square, Cardiff.

Colliery—PHŒNIX MERTHYR, Glyncorrwg Seam, Phœnix Glyncorrwg Pit.
Shipping Ports—Port Talbot, Cardiff, Swansea.
Rail—Rhondda and Swansea Bay, Cymmer Station.
Canal—None.

Phœnix Merthyr Coal.

Class of Coal—Smokeless Steam, Coking.

Sample of Phœnix Merthyr coal, sampled by me personally on May 16, 1905, all along the face of the seam, now working in the Left and Right Headings and Main Deep.

Ultimate analysis—	Per cent.
Carbon	87·640
Hydrogen	4·310
Oxygen	3·300
Nitrogen	1·450
Sulphur	·800
Ash	2·500
	100·000

GLAMORGAN.

Notes.

Complete analysis—

	Per cent.
Fixed carbon	79·90
Volatile matter	16·80
Ash	2·50
Sulphur	·80
	100·00

Calorific power (by Thompson's calorimeter)	8,580 calories
Calorific power, water evaporated at 212 degs. Fahr. per 1 lb. of coal	15·444 lb.
Yield of strong and dense coke	83·20 per cent.

Analyst—Arthur R. Roberts.
Date of Analysis—May 31, 1905.

PONTARDAWE COLLIERIES COMPANY LIMITED,

8, Exchange Buildings, Swansea.

Colliery—CWMNANT, Graigola Four-feet Seam, ... Pit.
Shipping Port—Swansea.
Rail—Midland, Pontardawe Station.
Canal—G.W.R., Swansea Vale.

Cwmnant Smokeless Steam Coal.

Class of Coal—Smokeless Steam.

	Per cent.
Carbon	85·44
Volatile matter	10·04
Sulphur	0·98
Ash	3·54

Analysts—Hy. A. Penrose and Co.
Date of Analysis—August 15, 1903.

Colliery—CWMDU, Pinchin, Four-feet, Three-inch Seam, ... Pit.

Cwmdu Anthracite Coal.

Class of Coal—Anthracite.

	Per cent.
Carbon	91·20
Volatile matter	6·50
Sulphur	0·71
Ash	1·59

Analysts—Hy. A. Penrose and Co.
Date of Analysis—August 15, 1903.

Notes.

GLAMORGAN.

PONTARDULAIS COLLIERIES COMPANY,

46, Queen Victoria Street, London, E.C.

Colliery—PONTARDULAIS, Four-foot Seam, Grove Pit.
Shipping Ports—Swansea, Llanelly.
Rail—Great Western and L. and N. W., Portardulais Station.
Canal— . . . .

Portardulais Smokeless Steam Coal.

Class of Coal—Smokeless Steam.

	Per cent.
Moisture	0·68
Volatile matter (including sulphur 0·98)	12·32
Fixed carbon	82·48
Ash	4·52
	100·00
Specific gravity	1·350
Calories (per Thompson's calorimeter test)	7,535

Analyst—B. Kitto.
Date of Analysis—October, 1903.

PYMAN, WATSON AND CO. LIMITED,

Cardiff.

Colliery—FFALDAU, ... Seam, ... Pit.
Shipping Ports—Cardiff, Port Talbot, Swansea.
Rail—Great Western, Pontycymmer Station.
Canal— . . . .

Oriental Merthyr Steam Coal.

Class of Coal—Smokeless Steam.

Sample taken throughout the shipment of a cargo :—

	Per cent.
Carbon	86·76
Hydrogen	4·76
Oxygen	2·24
Nitrogen	1·29
Sulphur	0·67
Ash	3·37
Moisture	0·91
	100·00

GLAMORGAN.

Notes.

Calorific value (determined by Thomson's calorimeter)	7,991 calories
Its evaporative value, by Thomson's calorimeter (water evaporated at 212 degs. Fahr. per pound of coal)	14·9 lb.
Specific gravity (water at 60 degs. Fahr. being 1·000)	1·299

The coal burns freely, is of good evaporative value, and it is noted also that very little waste is made owing to small passing through the bars. The small coal caking slightly prevents this loss to a very large extent.

Analyst—F. G. Treharne, F.C.S.

Date of Analysis—January 21, 1904.

TALBOT MERTHYR COLLIERY LIMITED,

83, Exchange, Cardiff.

Colliery—TALBOT MERTHYR, Mountain Seam, Level.

Shipping Ports—Port Talbot, Cardiff, Swansea.

Rail—Port Talbot, Port Talbot Station, or South Wales Mineral Railway.

Canal—None.

Talbot Merthyr Coal.

Class of Coal—Steam (Semi-bituminous).

Sample dried at 212 degs. Fahr. :—	Per cent.
Fixed carbon	78·02
Volatile matter	18·83
Ash	3·15
	100·00
Sulphur	1·28
Moisture	0·83

Analyst—J. S. Rowland.

Date of Analysis—March 5, 1900.

Notes.

GLAMORGAN.

TON PHILLIP RHONDDA COLLIERY COMPANY LIMITED,

8, Cambrian Place, Swansea.

Colliery—TON PHILLIP, Rock Vawr Seam, Ton Phillip Slants Pit.
Shipping Ports—Port Talbot, Swansea.
Rail—Port Talbot, Bryndu Station.
Canal—None.

Top Coal, Bottom Coal.

Class of Coal—Gas, Steam, Manufacturing, House.

	Top coal. Per cent.	Bottom coal. Per cent.
Fixed carbon	63·45	61·15
Volatile matter	34·10	36·50
Ash	2·45	2·35

Analysts—J. S. Merry and Co.
Date of Analysis—October 8, 1901.

TROEDYRHIW COAL COMPANY,

12, Bute Crescent, Cardiff.

Colliery—YNYSFAIO, Upper Four-feet Seam, Ynysfaio Pit.
Shipping Ports—Cardiff, Penarth, Barry, Newport, Port Talbot
Rail—Taff Vale, Treherbert Station.
Canal—None.

Ynysfaio Upper Four-feet Steam Coal.

Class of Coal—Steam.

	Per cent.
Fixed carbon	85·57
Volatile hydrocarbons	11·69
Sulphur	0·53
Ash	0·99
Moisture	1·22
	100·00

This is a remarkably pure coal.

Analysts—R. W. and A. J. Atkinson.
Date of Analysis—March 25, 1893.

GLAMORGAN.

Notes.

WESTERN VALLEYS ANTHRACITE COMPANY,

Gloster Chambers, Swansea.

Colliery—CWMGORSE, Red Vein Seam, ... Pit.
Shipping Ports—Swansea, Llanelly, Burry Port.
Rail—Great Western, Gwaun-Cae-Gurwen Station.
Canal—None.

Cwmgorse Anthracite.

Class of Coal—Anthracite.

The coal, dried at 100 degs. Cent., gave the following results :—

	Per cent.
Volatile matter	6·30
Ash	2·80
Fixed carbonaceous matter ..	90·90
	100·00

The composition of the dried coal was as follows :—

	Per cent.
Carbon	90·45
Hydrogen	3·64
Oxygen and nitrogen	2·05
Sulphur	1·06
Ash	2·80
	100·00

The sulphur in the ash was 0·15 per cent., making total sulphur 1·21 per cent. The calorific power was 8,540 calories, equivalent to 15·90 lb. of water evaporated from and at 100 degs. Cent. per pound of coal, the water formed by the combustion of the coal, (0·33 lb.) being condensed.

The coal contained 0·017 per cent. of phosphorus, and $\frac{1}{80}$th of a grain of arsenic per pound of coal.

Specially prepared coals for suction and pressure gas producing plants, the analysis of the actual coal taken from bulk being as follows :—

	Nuts.	Pea-nuts.	Peas.
Volatile	6·70 ..	6·40 ..	5·95 per cent.
Ash	4·75 ..	4·50 ..	4·50 per cent.
Fixed carbon ..	88·55 ..	89·10 ..	89·55 per cent.
Calories	8,154 ..	8,157 ..	8,130
B.T.U.	14,677 ..	14,682 ..	14,634

Analysts—Wm. Morgan and Seyler.
Date of Analysis—March 22, 1906.

(See also New Cross Hands Collieries Ltd.)

Notes.

PEMBROKESHIRE.

BONVILLES COURT COAL COMPANY,

Saundersfoot, R.S.O.

Collieries—BONVILLES COURT and KILGETTY, Lower Level and Kilgetty Seams, Bonvilles Court and Kilgetty Pits.
Shipping Port—Saundersfoot.
Rail—Great Western, Saundersfoot Station.
Canal—None.

Bonvilles Court and Kilgetty Anthracite.

Class of Coal—Anthracite.

	Per cent.
Carbon	94·18
Hydrogen	2·99
Oxygen	0·50
Nitrogen	0·76
Sulphur	0·59
Ash	0·98
	100·00

Analyst—Professor Frankland.
Date of Analysis— . . . .

REYNOLTON COLLIERY COMPANY,

83, Exchange, Cardiff.

Colliery—REYNOLTON, Bonvilles Court Seam, Reynolton Pit.
Shipping Port—Milford Haven.
Rail—Great Western, Kilgetty and Templeton Stations.
Canal—None.

Reynolton Anthracite Coal.

Class of Coal—Anthracite.

Sample dried at 212 degs. Fahr.—	Per cent.
Fixed carbon	93·08
Volatile matter	5·82
Ash	1·10
	100·00
Sulphur	0·57

This sample was carefully examined for arsenic, and only mere traces were found to be present.

Analyst—J. S. Rowland.
Date of Analysis—August 1, 1902.

PEMBROKESHIRE.

Notes.

HOOK COLLIERY COMPANY,

Haverfordwest.

Colliery—HOOK, Timber Vein Seam, Pill Pit.
Shipping Port—(River Wharf), Milford.
Rail—None.
Canal—None.

Anthracite.

Class of Coal—Anthracite.

The sample dried at 100 degs. Cent. gave :—

	Per cent.
Volatile matter	4·70
Ash	0·84
Fixed carbonaceous residue ..	94·46
	100·00

The composition of the dried coal was as follows :—

	Per cent.
Carbon	93·20
Hydrogen	3·20
Oxygen and nitrogen	2·00
Sulphur	0·76
Ash	0·84
	100·00

The coal as received contained 2·1 per cent. moisture. The sulphur in the ash was 0·05 per cent., making total sulphur 0·81 per cent. The calorific power was 8,608 calories, equivalent to 16·03 lb. of water evaporated from and at 100 degs. Cent. per pound of coal, the water formed by the combustion of the coal (0·29 lb.) being condensed. The sample contained a trace of arsenic, which we estimate at 1/100 of a grain per pound of coal.

Analysts—Wm. Morgan and Seyler.
Date of Analysis—September 29, 1904.

IRELAND.

Notes.

ROSCOMMON.

ARIGNA MINING COMPANY LIMITED,

Ballinamore, Carrick-on-Shannon.

Colliery— . . . . Seam, Aughabehy Pit.
Shipping Ports—Dundalk, Sligo.
Rail—Cavan and Leitrim, Arigna Station.
Canal—River Shannon.

Arigna Coal.

Class of Coal—Steam, Manufacturing, House.

	Per cent.
Moisture and loss on heating to 212 degs. Fahr.	1·25
Ash	6·40
Nitrogen	1·55
Sulphur	1·20
Carbon, with hydrogen and oxygen	89·60

This coal is a friable coal of a bituminous character, giving a flaming combustion. The heating power of this coal is high, and is not much under fine Irish anthracite. One gramme of this coal burnt in a Thompson's calorimeter gave a rise of temperature equal to 6·8 degs. Fahr., or 14,205·2 heat units. The heating power, therefore, is very high, whilst the sulphur and nitrogen being low makes this a valuable coal. I should think the slack of this coal would be specially valuable for making compressed fuel.

Analyst—C. R. C. Tichborne, LL.D., F.C.S., M.R.I.A., L.A.H.I.
Date of Analysis—February 4, 1889.

PART II.—COKE.

PART II.—COKE.

Notes

CUMBERLAND.

ALLERDALE COAL COMPANY LIMITED,

Workington.

Manufactured at— . . . .

Coal Employed— . . . .

Shipping Port—Workington.

Rail—Cleator and Workington Junction, Great Broughton Station.

Canal— . . . .

Buckhill Coke.

	Per cent.
Volatile matter	0·91
Carbon	87·97
Ash	9·40
Sulphur	0·79
Moisture	0·93
	100·00

Analyst—P. B. Melmore, Maryport.

Date of Analysis— . . . .

Mr. JOSEPH HARRIS,

Brayton Domain Collieries, Brayton.

Manufactured at—Brayton.

Coal Employed—Yard Band.

Shipping Ports—Maryport and Silloth.

Rail— . . . . Brayton Station.

Canal— . . . .

Brayton Domain Coke.

	Per cent.
Volatile matter	0·90
Carbon	89·08
Ash	7·84
Sulphur	1·53
Moisture	0·65
	100·00

Analyst—P. B. Melmore.

Date of Analysis—June, 1905.

Notes.

CUMBERLAND.

Messrs. THOMPSON & SONS,

Kirkhouse, Brampton Junction.

Manufactured at—Blenkinsop Colliery.

Coal Employed—Dust coal.

Shipping Port—Silloth.

Rail—North Eastern, Greenhead Station.

Canal— . . . . . .

Thompson's English Coke.

	Per cent.
Volatile matter	0·98
Fixed carbon	90·40
Sulphur	1·23
Ash	7·12
Water	0·27
	100·00
Phosphorus	0·012

This is a coke of first-class quality. It is very free from ash and contains only a moderate amount of sulphur. It is hard and durable and is altogether a coke of excellent quality.

Analysts—R. R. Tatlock and Thomson.

Date of Analysis—October 16, 1903.

WHITEHAVEN COLLIERY COMPANY,

Whitehaven.

Manufactured at—Whitehaven Collieries.

Coal Employed— . . . . . .

Shipping Port—Whitehaven.

Rail—Furness, and L. and N. W., Whitehaven Station.

Canal— . . . . . .

Whitehaven Coke.

	Sample as received. Per cent.
Fixed carbon	81·60
Volatile matter	7·12
Sulphur	1·75
Ash	9·30
Moisture	0·23
	100·00

Analyst—Robert Hellon.

Date of Analysis—November 30, 1903

Notes.

DERBY.

MICKLEY COAL CO. (DRONFIELD) LTD.,

Dronfield, Sheffield.

Manufactured at—Mickley Colliery, Mickley Lane.
Coal Employed—Mickley Thin Seam.
Shipping Ports—Hull and Goole.
Rail—Midland, Dronfield and Dore-and-Totley Stations.
Canal— . . . .

Foundry and Blast Furnace Coke.

First Analysis without Washing.

Composition.	As received. Per cent.	After drying. Per cent.
Moisture	0·11	0·00
Volatile matter	0·89	0·89
Fixed carbonaceous matter	93·49	93·59
Mineral matter (ash)	5·51	5·52
	100·00	100·00
Sulphur	1·69	1·70

Analysts—H. Allen and Partners, G. E. Scott and Smith, Sheffield.
Date of Analysis—September 4, 1905.

Second Analysis after Washing Slack.

	Per cent.
Moisture	0·46
Ash	6·09
Sulphur	1·41
Carbon (by difference)	92·04
	100·00

This coke is low in ash compared with the average coke of South and West Yorkshire. It is a very useful blast furnace coke, but would be improved by better grinding.

As the coke stands mechanically, it is suitable for foundry and steel melting purposes.

Analyst—W. McD. Mackey, Leeds.
Date of Analysis—January 26, 1906.

Notes.

DERBY.

SHEFFIELD COAL COMPANY LIMITED,

Birley, near Sheffield.

Manufactured at—Birley.

Coal Employed—Silkstone.

Shipping Ports—Humber Ports, Partington, Liverpool, King's Lynn

Rail—Great Central (Woodhouse Junction Station), and Midland (North Staveley Junction).

Canal— . . . . . .

Birley Silkstone Washed Hard Coke.

The coke is used for steel melting, for brass and other foundry purposes, and also for furnaces.

Analysis—	Per cent.
Carbon	93·21
Ash	5·74
Sulphur	0·72
Water	0·33
	100·00

Analyst—Elliot Barker, F.C.S.

Date of Analysis—May, 1905.

Notes.

DURHAM.

BEARPARK COAL AND COKE COMPANY LIMITED

Middlesbrough.

Manufactured at—Bearpark Brancepeth Colliery.
Coal Employed—Busty.
Shipping Ports—Tyne Dock and all North East Ports.
Rail—North Eastern, Aldin Grange Station.
Canal— . . . . . .

Bearpark Coke.

Average of numerous analyses—

	Per cent.
Carbon	89·60
Sulphur	0·98
Ash	9·42
	100·00

Analysts—Pattinson and Stead, and F. E. Thompson.

Date of Analysis—1906.

BELL BROS. LIMITED,

Middlesbrough.

Manufactured at—South Brancepeth Colliery, near Durham.
Coal Employed—Busty and Brockwell Seams.
Rail—North Eastern, Spennymoor Station.
Canal— . . . . . .

South Brancepeth Coke.

	Per cent.
Moisture	1·64
Ash	7·08
Sulphur	0·91
Volatile matter	0·71
Fixed carbon	89·66
	100·00

Average analysis over two months—January and February 1906.

Analyst—Weldon Hanson.

Date of Analysis– January and February, 1906.

Notes.

Durham.

Manufactured at—Browney Colliery, near Durham.
Coal Employed—Busty, Brockwell and Hutton Seams.
Rail—North Eastern, Ferryhill Station.
Canal— . . . . . .

Browney Coke.

	Per cent
Moisture	3·00
Ash	8·05
Sulphur	1·03
Volatile matter	0·61
Fixed carbon	87·31
	100·00

Average analysis over two months—January and February 1906.

Analyst—Weldon Hanson.
Date of Analysis—January and February, 1906.

Manufactured at—Tursdale Colliery, near Durham.
Coal Employed—Busty and Brockwell Seams.
Rail—North Eastern, Ferryhill Station.
Canal— . . . . . .

Tursdale Coke.

	Per cent.
Moisture	2·64
Ash	9·96
Sulphur	1·04
Volatile matter	0·82
Fixed carbon	85·54
	100·00

Average analysis over two months—January and February 1906.

Analyst—Weldon Hanson.
Date of Analysis—January and February, 1906.

DURHAM.

Notes.

CARTERTHORNE COLLIERY COMPANY LIMITED,

Zetland Buildings, Middlesbrough.

Manufactured at— . . . .

Coal Employed—Carterthorne Gas Coal.

Shipping Ports—Tyne Dock, West Hartlepool, Middlesbrough.

Rail—North Eastern, Evenwood Station.

Canal— . . . . . .

Carterthorne Gas Coal Coke.

	Per cent.
Carbon	96·02
Sulphur	0·76
Ash	3·22

Analysts—Pattinson and Stead.

Date of Analysis— . . . .

CONSETT IRON COMPANY LIMITED,

Blackhill, Co. Durham.

Manufactured at— . . . .

Coal Employed— . . . .

Shipping Port— . . . .

Rail— . . . . Station.

Canal— . . . .

Consett Caresfield Coke.

Being the result of frequent tests at ironworks, to which the coke was supplied.

	Per cent.
Carbon	90·30
Ash	8·40
Sulphur	0·85
Water	0·45

Analyst— . . . .

Date of Analysis— . . . .

Langley Park Coke.

	Per cent.
Carbon	90·60
Ash	8·00
Sulphur	0·95
Moisture	0·45

Analyst— . . . .

Date of Analysis— . . . .

Notes

DURHAM.

THE OWNERS OF HAMSTEELS COLLIERIES.

74, New Elvet, Durham.

Manufactured at—Hamsteels Collieries.

Coal Employed—Brockwell and Busty Seams, mixed.

Shipping Ports—All North East Ports.

Rail—North Eastern, Waterhouses Station.

Canal— . . . .

Middle Brancepeth Coke.

	Per cent.
Carbon	93·79
Ash	5·47
Sulphur	0·66
Moisture	0·08
	100·00
Phosphorus..	0·003

Analysts—Pattinson and Stead.

Date of Analysis—December, 1905.

HAMSTERLEY COLLIERY LIMITED,

Milburn House, Newcastle-on-Tyne.

Manufactured at—Hamsterley Colliery, Ebchester, R.S.O.

Coal Employed— . . . .

Shipping Ports—Dunston and Tyne Dock.

Rail— . . . . Station.

Canal— . . . .

Hamsterley Coke.

	Per cent.
Carbon	92·32
Sulphur	0·58
Ash	6·87
Moisture	0·23
	100·00

Analysts—J. and H. S. Pattinson.

Date of Analysis— . . . .

Notes.

DURHAM.

HETTON COAL COMPANY LIMITED,

Hetton-le-Hole.

Manufactured at—Lyons Colliery.
Coal Employed— . . . . . .
Shipping Ports—South Dock, and Hetton Staiths, Sunderland.
Rail—North Eastern, Hetton Station.
Canal— . . . . . .

Lyons Coke.

As analysed at works receiving regular supplies in 1889.

	Per cent.
Carbon	90·31
Ash	7·20
Sulphur	1·35
Moisture	1·14

Analyst— . . . . . .
Date of Analysis—1889

HORDEN COLLIERIES LIMITED,

Crown Street Chambers, Darlington.

Manufactured at— . . . . . .
Coal Employed—Main Seam.
Shipping Ports—East and West Hartlepool, South Dock, Tees & Tyne.
Rail—North Eastern, ... Station.
Canal— . . . . . .

Horden Coke.

	Per cent.
Carbon	89·23
Ash	6·06
Sulphur	1·01
Moisture	3·70
	100·00
Phosphorus	·0023

Analyst—W. F. K. Stock.
Date of Analysis—February 18, 1904.

Notes.

DURHAM.

LAMBTON COLLIERIES LIMITED,

Newcastle-on-Tyne.

Manufactured at— . . . .

*Coal Employed—*Lambton and Sherburn Washed Duff.

*Shipping Ports—*Lambton Staiths and Tyne Dock.

Rail— . . . . Station.

Canal— . . . .

Sherburn and Lambton Coke.

	Sherburn. Per cent.	Lambton. Per cent.
Moisture	0·38	0·41
Ash	7·42	7·32
Fixed carbon	90·63	90·91
Sulphur	1·57	1·36
	100·00	100·00

*Analyst—*G. P. Lishman, D.Sc., F.I.C.

*Date of Analysis—*March, 1906.

LOW BEECHBURN COAL COMPANY LIMITED,

Darlington.

*Manufactured at—*Low Beechburn.

*Coal Employed—*Ballarat, Busty, Five Quarter and Main Coal

*Shipping Port—*Middlesbrough.

Rail— . . . . Station.

Canal— . . . .

Low Beechburn Coke.

	Per cent.
Carbon	90·40
Ash	8·70
Sulphur	0·77
Moisture	0·13

Analyst— . . . .

*Date of Analysis—*January, 1906.

Notes.

DURHAM.

PRIESTMAN COLLIERIES LIMITED,

Milburn House, Newcastle-on-Tyne.

Manufactured at— . . . .
Coal Employed— . . . .
Shipping Ports—Dunston and Tyne Dock.
Rail— . . . . Station.
Canal— . . . .

Waldridge Coke.

	Per cent.
Carbon	91·06
Sulphur	0·91
Ash	7·87
Moisture	0·16

Analysts—J. and H. Pattinson.
Date of Analysis— . . . .

Victoria Garesfield Coke.

	Per cent.
Carbon	92·89
Sulphur	0·68
Ash	6·43

Analysts—J. and H. Pattinson.
Date of Analysis— . . . .

Messrs. S. A. SADLER LIMITED,

Middlesbrough.

Manufactured at—Malton Colliery, near Durham, and Etherley Grange, Durham.
Coal Employed—Malton, Brockwell and Busty.
Shipping Ports—Middlesbrough, Tyne Dock and Sunderland.
Rail—North Eastern, Lanchester Station.
Canal— . . . .

Malton Foundry Coke.

	Per cent.
Carbon	90·86
Ash	8·20
Sulphur	0·94

Analyst—J. Preston.
Date of Analysis—September, 1906.

Notes.

DURHAM.

Malton Furnace Coke

	Per cent.
Carbon	90·13
Ash	8·82
Sulphur	1·05

Analyst—J. Taylor.

Date of Analysis—September, 1906.

SOUTH HETTON COAL COMPANY LIMITED,

Sunderland.

Manufactured at—Murton Coke Works.

Coal Employed—South Hetton Murton Duff Coal.

Shipping Ports—Sunderland and Seaham Harbour.

Rail—North Eastern, South Hetton Colliery Sidings.

Canal— . . . . . .

Murton Coke.

	Per cent.
Carbon	93·71
Ash	4·40
Sulphur	1·49
Moisture	0·40

Analyst—W. F. Keating Stock.

Date of Analysis— . . . . . .

STRAKERS & LOVE,

Newcastle-on-Tyne.

Manufactured at— . . . . . .

Coal Employed— . . . . . .

Shipping Ports—Tyne Dock, South Dock, Sunderland, Middlesbro' Dock, and all North East ports.

Rail— . . . . . . Station.

Canal— . . . . . .

Brancepeth Coke.

	Per cent.
Carbon	95·77
Sulphur	0·71
Ash	3·40
Water	0·12

Notes.

DURHAM.

The coke is probably the finest produced in the Durham coalfield; it is considered a standard quality for purposes of comparison, and is shipped to all parts of the world.

From works where the coke is in constant use, the highest percentage of sulphur contained in it is stated to have been 0·84.

Analyst—John Pattinson.
Date of Analysis—April 16, 1887.

WEARDALE STEEL, COAL AND COKE COMPANY LIMITED,

Newcastle-on-Tyne.

Manufactured at— . . . .
Coal Employed— . . . .
Shipping Ports—Tyne, Middlesbrough, Hartlepool.
Rail— . . . . Station.
Canal— . . . .

Black Prince Coke.

As analysed at ironworks over four months in 1885.

	1st. Per cent.	2nd. Per cent.	3rd. Per cent.	4th. Per cent.
Carbon	92·81	93·07	93·59	94·40
Ash	5·60	5·40	5·10	4·10
Moisture	0·80	0·70	0·60	0·70
Sulphur	0·79	0·83	0·71	0·76

The average of ash in this coke in actual use was in the year 1884 4·97 per cent., and in 1883 5·50 per cent.

Analyst— . . . .
Date of Analysis—1885.

Notes.

THE OWNERS OF WEST STANLEY COLLIERY,

Newcastle-on-Tyne.

Manufactured at—West Stanley Colliery.
Coal Employed—Busty and Brockwell Seams.
Shipping Ports—Tyne Dock, Dunston, Sunderland, Blyth, Howdon and Albert Edward Docks, and Commissioners' Spouts.
Rail— . . . . Shield Row Station.
Canal— . . . .

West Marley Hill Coke.

	Per cent.
Fixed carbon	93·64
Volatile hydrocarbons	0·60
Ash	5·36
Moisture	0·40
Sulphur	0·85

Analyst—W. H. Blake.
Date of Analysis—August 30, 1906.

Notes

GLOUCESTER.

BEDMINSTER, EASTON, KINGSWOOD AND PARKFIELD COLLIERIES LIMITED.

Easton Colliery, Bristol.

Manufactured at—Kingswood Colliery.
Coal Employed—Kingswood Coal.
Shipping Ports—Bristol and Avonmouth.
Rail—Midland, Fishponds Station.
Canal—None.

Kingswood Foundry Coke.

	Per cent.
Carbon	93·05
Sulphur	0·41
Ash	6·95
Moisture	0·34

Analyst—Ernest Henry Cook, D.Sc. (Lond.)
Date of Analysis—October 2, 1908.

LYDNEY AND CRUMP MEADOW COLLIERIES COMPANY LIMITED,

Cinderford, Forest of Dean.

Manufactured at—Cinderford, Glos.
Coal Employed—Crumpmeadow Starkey.
Shipping Ports—Lydney, Sharpness, Newport and Cardiff.
Rail—Great Western Railway and Severn and Wye Joint Railway, Cinderford Station.
Canal—None.

Crump Meadow Starkey Hop Drying Coke.

	Per cent.
Moisture	0·20
Ash	5·15
Volatile matter	11·20
Fixed carbon	83·45
	100·00

	Per cent.
Total sulphur	0·988
Phosphorus	0·010
Total arsenic per pound of coke	$\frac{1}{85}$ grain

Analyst—G. R. Thompson.
Date of Analysis—August 25, 1905.

Notes.

LANCASHIRE.

ALTHAM COLLIERY COMPANY LIMITED,

Accrington.

Manufactured at—Altham Colliery (in Patent Ovens).
Coal Employed—Lower Mountain Mine.
Shipping Ports—Liverpool, Manchester.
Rail—Lancashire and Yorkshire, Simonstone Station.
Canal—Leeds and Liverpool.

Altham Patent Coke.

	Per cent.
Carbon	92·60
Sulphur	0·52
Ash	6·36
Moisture	0·52
	100·00

Analyst—Edward Riley, F.I.C., F.C.S.
Date of Analysis—July, 1904.

Manufactured at—Great Harwood Colliery.
Coal Employed—Lower Mountain Mine.
Shipping Port—Liverpool.
Rail—Lancashire and Yorkshire, Martholme Siding, Great Harwood Station.
Canal— . . . .

Altham Beehive Coke.

	Per cent.
Carbon	92·000
Ash	7·000
Sulphur	0·510
Moisture	0·490
	100·000

Analyst—N. Eltoft.
Date of Analysis—June 19, 1906.

Notes.

LANCASHIRE.

EXECUTORS OF COLONEL HARGREAVES,

Burnley.

Manufactured at—Burnley.
Coal Employed—Mountain Mine.
Shipping Port—Liverpool.
Rail—Lancashire and Yorkshire, Rose Grove Station.
Canal—Leeds and Liverpool.

Best Habergham Foundry Coke.

	Per cent.
Fixed carbon	93·70
Volatile matter	1·00
Moisture	0·20
Ash	5·10
Sulphur in ash	0·73

Analyst—Raymond Ross.
Date of Analysis—March 3, 1906.

Manufactured at—Burnley.
Coal Employed—"Gannister Beds of Coal."
Shipping Port—Liverpool.
Rail—Lancashire and Yorkshire . . . . . . Station.
Canal—Leeds and Liverpool.

Best Foundry Coke.

	Per cent.
Carbon	93·66
Sulphur	0·58
Ash	5·26

Analyst—Edward Riley.
Date of Analysis—March, 1905.

	Per cent.
Carbon	93·51
Sulphur	0·48
Ash	4·58

Analysts—Pattinson and Stead.
Date of Analysis—March, 1905.

Notes.

LANCASHIRE.

Best Foundry Coke—*cont.*

	Per cent.
Carbon	93·00
Sulphur	0·50
Ash	4·90

Analyst—Mr. Raymond Ross.
Date of Analysis—March, 1905.

	Per cent.
Carbon	92·74
Sulphur	0·60
Ash	6·26

Analyst—Wm. McD. Mackey.
Date of Analysis—March, 1905.

MESSRS. GEO. HARGREAVES AND CO.

The Collieries, Accrington.

Manufactured at—Huncoat.
Coal Employed—Lower Mountain Mine.
Shipping Ports—Fleetwood and Manchester.
Rail—Lancashire and Yorkshire, Accrington Station.
Canal— . . . . . .

Lower Mountain Mine Coke.

	Per cent.
Carbon	91·95
Sulphur	0·59
Ash	7·15
Moisture	0·31
	100·00

Analyst—Edward Riley.
Date of Analysis—October 17, 1904.

LANCASHIRE.

Notes.

PLATT BROS. AND CO. LIMITED,

Hartford Ironworks, Oldham.

Manufactured at—Butterworth Hall and Jubilee Collieries, Milnrow, near Rochdale.

Coal Employed—Mountain Mine.

Shipping Port— . . . .

Rail—Lancashire & Yorkshire, Milnrow and Jubilee Colliery Sidings.

Canal— . . . .

Milnrow and Jubilee Foundry Coke.

	No. 1. Per cent.	No. 2. Per cent.
Carbon	94·28	94·21
Sulphur	0·45	0·55
Moisture	0·22	0·16
Ash	5·05	5·08
	100·00	100·00

This is one of the finest qualities of foundry coke put on the English market.

Analyst—Mr. Tatlock, Glasgow.

Date of Analysis— . . . .

Notes.

MONMOUTH.

NEWPORT ABERCARN BLACK VEIN STEAM COAL COMPANY LIMITED,

Newbridge.

Manufactured at—Abercarn.
Coal Employed—Newport Abercarn Black Vein.
Shipping Ports—Newport, Cardiff, Penarth, Barry.
Rail—Great Western, Abercarn Station.

Newport Abercarn Black Vein Foundry Coke.

	Per cent.
Carbon	91·41
Sulphur	0·63
Ash	7·76
Moisture	0·20
	100·00

Analyst—Edward Riley, F.I.C., F.C.S.
Date of Analysis—February 16, 1903.

NORTHUMBERLAND.

ASHINGTON COAL COMPANY LIMITED,

Newcastle-on-Tyne.

Manufactured at— . . . .
Coal Employed—Ashington Washed Duff Coal.
Shipping Ports—Blyth and the Tyne.
Rail— . . . . Ashington Station.

Ashington Duff Coal (Washed) Coke.

Coke	62·80
Ash in coke	11·30
Sulphur in coke	0·88

Analyst— . . . .
Date of Analysis— . . . .

Notes.

SHROPSHIRE.

LILLESHALL COMPANY LIMITED.

Priors Lee Hall, Shifnal.

Manufactured at—Priors Lee and Lodge.
Coal Employed—Clod, Double and Flint.
Shipping Port—None shipped, all used in own works.
Rail—G. W. R. and L. and N. W. R., Oakengates and Donnington Stations.
Canal—Humber Arm (S. N. C. Co.).

Priors Lee Coke, Lodge Coke.

	Priors Lee Coke. Per cent.		Lodge Coke. Per cent.
Carbon	86·57	..	84·25
Ash	11·25	..	13·05
Sulphur	1·08	..	1·37
Moisture	1·10	..	1·33
	100·00	..	100·00

Analyst—G. A. Jarvis, F.C.S.
Date of Analysis—March 10, 1906.

Notes.

YORKSHIRE.

CAMMELL, LAIRD AND CO. LIMITED,

New Oaks Colliery, near Barnsley.

Manufactured at—Oaks Collieries.
Coal Employed— . . . . . .
Shipping Port— . . . . . .
Rail— . . . . . . Station.
Canal— . . . . . .

The following is the result of an average from January to June, 1904, of the cokes sent to Cyclops Works :—

	Per cent.
Ash	3·803
Sulphur	1·052

The following is the result of an average for 1905, of coke sent to Cyclops Works :—

	Per cent.
Ash	4·179
Sulphur	1·214

Analyst— Deby.
Date of Analysis— . . . . . .

CARGO FLEET IRON COMPANY LIMITED,

Middlesbrough.

Manufactured at—Cargo Fleet Ironworks.
Coal Employed—From various collieries in Durham district.
Shipping Port—*Nil.*
Rail—North Eastern, Southbank Station.
Canal— . . . . . .

Cargo Fleet Coke.

	Per cent.
Fixed carbon	88·45
Ash	9·34
Sulphur	1·19
Moisture	1·02

Analyst—A. Braithwaite.
Date of Analysis—March 10-20, 1906.

YORKSHIRE.

Notes.

DALTON MAIN COLLIERIES LIMITED,

Parkgate, Rotherham.

Manufactured at—Silverwood Colliery. (By-product ovens.)
Coal Employed—Washed Smudge.
Shipping Ports—Hull, Goole, Grimsby, Keadby, Liverpool, Manchester Ship Canal, Boston.
Rail—Midland and Great Central Railways, Rawmarsh (Midland), Aldwarke (Great Central) Stations.
Canal—Sheffield and South Yorkshire Navigation.

Blast-furnace Coke.

	Per cent.
Moisture	0·90
Sulphur	1·18
Volatile matter	0·37
Ash	8·52
Carbon	89·03
	100·00

Analyst—G. L. Chrisp.
Date of Analysis—May 18, 1906.

S. FOX AND CO. LIMITED,

Stocksbridge, near Sheffield.

Manufactured at—Stocksbridge Works, near Sheffield.
Coal Employed—Halifax Soft Coal.
Shipping Port—None; all coke being consumed in own works.
Rail—Great Central, Deepcar Station.
Canal—None.

Steel Coke from Halifax Soft Coal.

	Per cent.
Carbon	90·86
Sulphur	0·98
Ash	6·81
Moisture	1·35
	100·00
Calorific power	10·45 degs.

Analyst—R. Harris.
Date of Analysis—April 2, 1906.

Notes.

YORKSHIRE.

LIVERSEDGE COAL COMPANY,

Liversedge.

Manufactured at—Liversedge.
Coal Employed—Low Moor Better Bed Seam of Coal.
Shipping Port—None.
Rail—Lancs. and Yorks., Liversedge Station.
Canal—None.

Better Bed Special Foundry Coke.

	Per cent.
Moisture	0·13
Ash	6·53
Sulphur	0·48
Hydrogen, oxygen and nitrogen	0·68
Carbon (by difference)	92·18
	100·00

Analyst—The *Quarry* Investigation, Testing and Analysis Department, London.

Date of Analysis—September 11, 1906.

The sample submitted is a strong hard coke, with good lustre, and is, in our opinion, a coke of superior quality, and very suitable for use as a best foundry coke.

Working test—Furnace 28 in. at tuyeres; bed 5 cwt. coke.

	Iron. Cwt.	Coke. Lb.
First charge	9	0
Second ,, ...	8	56
Third ,, ...	8	56
Fourth ,, ...	8	56
Fifth ,, ...	8	56
Sixth ,, ...	8	56
Seventh ,, ...	8	56
Eighth ,, ...	8	56
Ninth ,, ...	8	56
Tenth ,, ...	8	56
Eleventh ,, ...	5	no coke
Iron melted	4 tons 5 cwt.	
Coke consumed, not reckoning drop ..	9½ cwt.	

Iron very hot. Type of furnace: receiver flat tuyeres.

YORKSHIRE.

Notes.

LOFTHOUSE COLLIERY COMPANY,

Lofthouse Colliery, near Wakefield.

Manufactured at—Lofthouse.
Coal Employed—Silkstone.
Shipping Ports—Goole, Hull.
Rail—Great Northern, Lofthouse Station.
Canal—Aire and Calder Navigation.

Lofthouse Coke.

Average analysis of three tests—	Per cent.
Moisture given off at 212 degs. Fahr. ..	0·50
Combustible matter..	91·38
Ash	8·12
	100·00
Total sulphur	0·91

Analyst—Thomas Fairley.
Date of Analysis—May 23, 1903.

LOW MOOR COAL COMPANY LIMITED,

Low Moor, Bradford.

Manufactured at—Low Moor.
Coal Employed—Low Moor Better Bed.
Shipping Port— . . . .
Rail—Lancs. and Yorks., Low Moor Station.
Canal— . . . .

Better Bed Coke.

	Per cent.
Ash	5·68
Sulphur	0·48
Moisture	0·69
Carbon	93·15
	100·00

Analyst—Wm. McD. Mackey.
Date of Analysis—June 19, 1902.

Notes.

YORKSHIRE.

NEWTON, CHAMBERS AND CO. LIMITED,

Thorncliffe, near Sheffield.

Manufactured at—Thorncliffe Collieries.
Coal Employed— . . . .
Shipping Ports— . . . .
Rail— . . . . Station.
Canal— . . . .

Foundry Coke.

	Per cent.
Carbon	91·37
Ash	7·56
Sulphur	0·82
Moisture	0·25
	100·00

Analyst— . . . .
Date of Analysis— . . . .

OLD SILKSTONE COLLIERIES LIMITED,

Dodworth, near Barnsley.

Manufactured at—Old Silkstone Collieries.
Coal Employed— . . . .
Shipping Ports—Keadby, Hull, Goole, Grimsby, Partington, Liverpool, &c.
Rail—Great Central, Dodworth Station.
Canal— . . . .

Dodworth Furnace Coke (Unwashed).

	Per cent.
Ash	12·90
Sulphur	1·25
Moisture	1·42
Carbon (by difference)	83·93
	100·00

Analyst— . . . .
Date of Analysis— . . . .

Old Silkstone Special Foundry Coke.

	Per cent.
Ash	6·60
Sulphur	0·71
Moisture	0·24
Carbon (by difference)	92·45
	100·00

Analyst— . . . .
Date of Analysis— . . . .

Notes.

DUMBARTON.

J. AND A. F. WALLACE,

Kirkintilloch.

Manufactured at—Wester Gartshore Colliery.
Coal Employed—Coking Coal (Kilsyth).
Shipping Ports—Queen's Dock, Bo'ness.
Rail—North British, Wester Gartshore Siding.
Canal—Forth and Clyde.

Wester Gartshore Foundry Coke.

The sample was nearly 4 ft. in depth, representing the contents of the coke oven from top to bottom.

	Per cent.
Carbonaceous or combustible matter	93·74
Sulphur	0·48
Ash	5·08
Water	0·70
	100·00
Heat units derived from the burning of the coke, Centigrade	7,765
Heat units derived from the burning of the coke, Fahrenheit	13,977
Heating or evaporating power (theoretical), in pounds of boiling water converted into steam by 1 lb. of coke	14·38 lb.
Evaporative power (practical) in the same terms	13·21 lb.

Analyst—William Wallace.
Date of Analysis—May 28, 1888.

Notes.

LANARKSHIRE.

DARNGAVIL COAL COMPANY LIMITED,

40, St. Enoch Square, Glasgow.

Manufactured at—Dalserf Coke Works.

Coal Employed—Lower Drumgray.

Shipping Ports—Glasgow, Greenock, Bo'ness, Grangemouth, Leith, Granton.

Rail—Caledonian, Stonehouse Station.

Canal— . . . . . .

Swinhill Foundry Coke.

	Per cent.
Volatile matter	1·95
Fixed carbon	93·00
Sulphur	0·90
Ash	3·75
Water	0·40
	100·00

Analysts—R. R. Tatlock and Thomson.

Date of Analysis—December 15, 1903.

Notes

STIRLING (EAST).

ALLOA COAL COMPANY LIMITED,

Alloa.

Manufactured at—Bannockburn Colliery and Carnock Colliery.

Coal Employed—Bannockburn Coking Gas Coal.

Shipping Ports—Glasgow, Greenock, Grangemouth, Bo'ness, Dundee, Leith, Alloa.

Rail—Caledonian, Plean Station.

Canal—None.

Malting Coke.

	Per cent.
Carbon	94·76
Sulphur	0·45
Ash	4·67
Water at 212 degs. Fahr... ..	0·12
	100·00

Specific gravity of coke .. .. ·861 (water 1·000)
Weight of 1 cubic foot .. .. 53·81 lb.

Heating power of coke as determined by Thomson's calorimeter:—1 lb. of coke evolves heat sufficient to convert 13·8 lb. of water from 212 degs. Fahr. into steam.

This coke is of remarkable chemical purity, containing a very small percentage of ash; the amount of sulphur present is exceptionally low, while in physical properties it is hard and compact, possessing a good, steel grey colour, and is undoubtedly a first-class coke.

Analyst—J. W. Napier, F.C.S., M.S.C.I.

Date of Analysis—December 18, 1905.

Coal Employed—Bannockburn Wallsend.

The Alloa Coal Company's Foundry Coke.

	Per cent.
Carbon	96·68
Sulphur	0·36
Ash	2·90
Water at 212 degs.	0·06
	100·00

Specific gravity of the coke .. .. ·661 (water 1·000).
Weight of 1 cubic foot .. .. .. 41·31 lb.

Notes

STIRLING (EAST).

The Alloa Coal Company's Foundry Coke—*cont.*

Heating power of the coke as determined by Thomson's calorimeter:—1 lb. of the coke by perfect combustion evolves heat sufficient to convert 14·0 lb. of water from 212 degs. Fahr. into steam.

This is a foundry or kiln coke of remarkable chemical purity, containing an exceptionally small percentage of sulphur and ash, while in physical properties it possesses all the other essential characteristics of a first-class, or ideal, coke for foundry or iron-smelting purposes. It is exceptionally hard and compact, of light steel-grey colour, and columnar or prismatic in form while in large pieces.

Analyst—Geo. R. Hislop, F.C.S., F.I.Inst., F.R.S.S.A.

Date of Analysis—December 4, 1894.

PLEAN COLLIERY COMPANY LIMITED,

65, Renfield Street, Glasgow.

Manufactured at—Plean Collieries, Plean.

Coal Employed—Bannockburn.

Shipping Ports—Glasgow, Ardrossan, Greenock, Grangemouth, Bo'ness, Methil, Burntisland, Leith, Granton.

Rail—Caledonian, Plean Station.

Canal— . . . . . .

Plean Foundry Coke.

A sample of this coke gave on examination the following results:—

	Per cent.	Lb. per ton.
Carbon	92·44	2,070·656
Sulphur	0·39	8·736
Ash	5·75	128·800
Water	1·42	31·808
	100·00	2,240·000

Specific gravity .. .. .. ·604 (water 1·000)
Weight of 1 cubic foot .. .. 37·75

Heating power of the coke as determined by Thomson's calorimeter:—1 lb. of the coke by perfect combustion generates heat sufficient to convert 12·65 lb. of water from 212 degs. Fahr. into steam.

Analyst—Geo. R. Hislop, F.C.S., F.R.S.S.A.

Date of Analysis—April 4, 1896.

Notes.

GLAMORGANSHIRE.

CORY BROS. AND CO. LIMITED,

Cardiff.

Manufactured at— . . . . . .

Coal Employed— . . . . . .

Shipping Port— . . . . . .

Rail— . . . . . . Station.

Canal— . . . . . .

Cory's Foundry Coke.

	Per cent.
Moisture	0·58
Ash	4·17
Sulphur	0·57
Carbon	94·68
	100·00

Analyst—F. Gwilym Treharne, F.R.M.S.

Date of Analysis— . . . . . .

Cory's Washed Furnace Coke.

	Per cent.
Fixed carbon	92·69
Ash	5·63
Sulphur	1·09
Moisture	0·59
	100·00

Analyst—F. Gwilym Treharne, F.R.M.S.

Date of Analysis— . . . . . .

Cory's Second Quality Foundry Coke.

	Per cent.
Carbon	92·04
Hydrogen	0·21
Oxygen	0·33
Nitrogen	0·07
Sulphur	0·93
Ash (mineral matter)	6·27
Water (moisture)	0·15
	100·00

Analyst—J. W. Thomas, F.C.S., F.Inst.Chem.

Date of Analysis— . . . . . .

Notes.

GLAMORGANSHIRE.

GREAT WESTERN COLLIERY COMPANY LIMITED,

The Exchange, Bristol.

Manufactured at—Pontypridd.
Coal Employed— . . . .
Shipping Ports—Cardiff, Penarth, Barry, Newport, Port Talbot, Swansea.
Rail—Taff Vale, Pontypridd Station.
Canal—None.

Foundry and Furnace Coke.

Made out of washed and ground coal from the Great Western Colliery Company's pits and burned in Coppée and Otto ovens.

	Per cent.
Carbon (by difference)	93·234
Sulphur	0·774
Phosphorus	0·022
Ash	5·970
	100·000

Analyst—F. G. Treharne.
Date of Analysis— . . . .

PYMAN, WATSON AND CO. LIMITED,

Cardiff.

Manufactured at—Ffaldau Collieries.
Coal Employed—Coking.
Shipping Ports—Cardiff, Port Talbot, Swansea.
Rail—Great Western, Pontycymmer Station.
Canal— . . . . . .

Ffaldau Foundry Coke.

Sample dried at 212 degs. Fahr.

	Per cent.
Carbon (by difference)	94·317
Sulphur	0·691
Phosphorus	0·016
Ash	4·976
	100·000

The coke is of excellent quality, capable of carrying a heavy burden. Its low content of sulphur and phosphorus is of great advantage, and makes it of special value to those who are manufacturing low phosphorus steel.

Analyst—F. G. Treharne, F.C.S.
Date of Analysis—January 23, 1904.

APPENDIX.

APPENDIX.

CLASSIFICATION OF COALS,

AND THE

INTERPRETATION OF ANALYSES.

IN the preceding pages we have a collection of analyses and assays of British coals and cokes classified according to the district from which they are derived. These analyses seem mostly to represent samples sent by the producers to the analyst and circulated as an indication of the quality of the coal. This raises the very important question of the method of sampling adopted. In some cases, from the nature of the assay, fairly large quantities of coal must have been used. In others, however, there can be little doubt that the analysis represents a picked sample and not an average one. Thus, when we find an analysis with about 0·6 per cent. of ash, we may feel fairly confident that this cannot represent the average of any large quantity of coal. For certain purposes it is permissible and even desirable to pick a sample as free as possible from impurities for analysis—namely, when it is desired to arrive at a judgment of the nature of the true combustible substance of pure coal. A large quantity of impurities such as ash or sulphur interferes to a great extent with the correct analysis of a coal. When, however, the nature of the coal is known, it is the average quantity of the impurities, ash, sulphur, phosphorus, or arsenic, which is of importance. To obtain a small sample which shall fairly represent these impurities is not an easy matter. It is to be regretted that a careful sampling by an expert and impartial sampler is not oftener resorted to. A certificate of correct sampling attached to each analysis would largely increase its value in the eyes of those who buy coal. The ideal would be a complete analysis upon a picked sample as free as possible from impurities, together with a partial analysis upon a certified average sample. Some firms have already seen the necessity of this, under the pressure of the scepticism with which the analysis of selected samples is met, and at least one example is to be found in this collection.

This is not the place to enter into a discussion of the best methods of obtaining an average sample, but it must be pointed out that no haphazard method is of any use. Systematic procedure must be adopted upon the lines which are universally used by buyers and vendors in the sampling of minerals. No analysis, however accurate, can be of greater value than is determined by the care devoted to the sampling.

Of the numerous results to be found in this collection, very many are not "analyses" in the strict sense of the word, but rather "assays" or tests. This is obvious in the case of the tests usually given of gas coals, which are the results of actual trials of the coal for gasmaking purposes on a small scale. But it is not always equally obvious that a determination of the "volatile matter," or even of the ash, is not really an analysis but an assay. The estimation of the sulphur, phosphorus and arsenic, or the ultimate composition (the percentage of carbon, hydrogen, oxygen and nitrogen) are true analyses. They are determinations of the actual amounts of certain definite elements, and are not subject to any ambiguity of meaning. It is far otherwise with such results as "volatile matter."

The manner in which coal breaks up upon heating varies very greatly with the time and temperature, and the nature of the vessel in which it is heated. It is a highly-complicated and destructive distillation, and is not capable of being represented by any simple chemical equation. The results of different analysts cannot be expected to agree unless all use a standard method. In the case of coals containing a very high volatile matter, these differences may be enormous. In the present collection of results there is in no case any indication of the method employed for the determination of the volatile matter, and it is therefore very doubtful how far the results of one analyst are comparable with those of any other. There are certain methods which have obtained a wide recognition, and it would be very desirable in future that all assays for volatile matter should be made by one of these processes, and accompanied by an indication of the method employed. Leaving aside the older method of Hinrichs (*Chem. News*, vol. xviii., p. 53), in which the powdered coal was heated in a platinum crucible for three and a-half minutes over an ordinary Bunsen burner, and then for three and a-half minutes over the blow-pipe, there are practically only two methods of wide acceptation in which the conditions of treatment are exactly laid down, that of *Fresenius and Muck*, widely used on the Continent, and that of the Committee on Coal Analysis appointed by the American Chemical Society, which we may call the *American Official Method*. In view of the fact that this determination is a purely conventional one—that is to say, has only a definite meaning when it is agreed to follow exactly certain directions—it may be acceptable to coal users and buyers to have these conditions before them, and they are therefore given in this place.

Method of Fresenius and Muck (Fresenius, *Quant. Chem. Anal.*, vol. 2, section 272).—A quantity of the (powdered) coal not exceeding 1 gramme, or even less with strongly caking coal, is placed in a platinum crucible with a closely-fitting lid

(except, of course, at one place for the escape of the gases). The crucible must have a large surface, and for very gassy coal be over 30 mm. in height. It is placed on a triangle of *thin* platinum wire, so that the bottom of the crucible is 30 mm. distant from the top of a Bunsen burner fitted with a chimney, and having a flame not less than 18 cm. high when burning free, until any flame issuing between the crucible and lid has almost entirely disappeared.

The variation in the results is said to be usually far under 1 per cent. This method, while it is no doubt good for caking coals, is not altogether definite, and in my opinion unsuitable for anthracites or coals low in volatile matter, and I much prefer the American method.

Method of the American Coal Committee (*Journal* Am. Chem. Soc., vol. xxi., pp. 1122-1126).—"Place 1 gramme of fresh undried coal in a platinum crucible, weighing 20 or 30 grammes, and having a tightly-fitting cover. Heat over the full flame of a Bunsen burner for seven minutes. The crucible should be supported on a platinum triangle with the bottom 6 to 8 centimetres above the top of the burner. The flame should be fully 20 cm. high when burning free, and the determination should be made in a place free from draughts. The upper surface of the cover should burn clear, but the under surface should remain covered with carbon. To find 'volatile combustible matter' subtract the percentage of moisture from the loss found here."

Even when these directions are carefully followed, not inconsiderable differences may occur according to the moisture and fineness of the coal, size of crucible, &c. Usually the duplicate may be expected to agree within about 0·5 per cent.

In every case, if the volatile matter is determined upon the moist coal, the water must be deducted, and the volatile matter calculated upon the dry coal. It is not always made perfectly clear in this collection of analyses whether the moisture has been deducted. The terms "volatile combustible matter" or "volatile hydrocarbons" sometimes used are not strictly correct, since a variable proportion of the decomposition products consists of water. The simple term "volatile matter" is better, provided it is understood that its production is due to decomposition of the coal and not to simple volatilisation. Far greater objection, however, must be taken to the expression "fixed carbon," which is here so frequently employed for the residue left after expelling the volatile matter and deducting the ash. This should be described as "fixed combustible residue" or "fixed carbonaceous residue." It is true that it consists very largely of carbon, so that it may be thought merely pedantic to object to the term "fixed carbon." But as a matter of fact it is very far from being pure carbon, and contains frequently large percentages of oxygen, nitrogen, and sulphur, and even hydrogen. To call it "fixed carbon" is very misleading, since it is often confused by commercial men with the true carbon, which is reported in the ultimate analysis. Thus, in the case of anthracites we find that the "fixed carbon" is often actually greater than the total carbon, which is

absurd and perplexing to those who are not chemists. Still less to be defended is the idea of "volatile carbon" when obtained by deducting the so-called "fixed carbon" from the total carbon. In anthracites this would often work out to a negative quantity! The true amount of fixed carbon could be obtained by an ultimate analysis of the fixed residue, but it would not be worth the trouble considering the conventional nature of the "fixed carbonaceous residue" itself.

An excellent practice has been followed by some analysts of giving a careful description of the nature of the coke or fixed residue left upon heating the powdered coal. An equally commendable practice is that of giving a description of the mechanical nature and physical qualities of the coal in the lump state, though of course this is not possible when the coal has been broken down for the purposes of sampling. It is desirable in such cases that a specimen lump should also be sent in order that these characteristics may be recorded.

Even the amount of *ash* in a coal is not quite free from ambiguity unless the determination is always made in the same way. The ash, as is well known, does not correctly represent the mineral matter present originally in the coal. By the process of combustion, water and carbonic acid present in such mineral matters as clay and carbonate of lime are expelled, while a portion of the sulphur is driven off from pyrites and a part remains behind as sulphates. These reactions vary according to the temperature and supply of oxygen during the combustion, so that it is quite usual to find that the ash determined by combustion in an open vessel is lower than that obtained in a combustion tube in a current of oxygen. The amount of sulphur left in the ash will also differ in the two cases. That part of the sulphur remaining in the ash after the combustion made for the ultimate analysis must be estimated and deducted from the total sulphur, or it will appear twice in the complete analysis. The difference between the total sulphur and that remaining in the ash is sometimes spoken of as the "combustible sulphur," but it is seldom sufficiently clear in the published analyses whether this or the total sulphur is meant. In most cases the difference between the two is not great, but this is not invariably the case.

By the *ultimate analysis* we mean the actual percentage of the elements carbon, hydrogen, nitrogen and oxygen present in the coal. The correct estimation of the carbon and hydrogen is a matter of some delicacy, but with care is capable of considerable accuracy. Duplicate analyses should always be made, and should agree to about 0·20 per cent. in the carbon, and to considerably less than 0·10 in the hydrogen. Differences of anything like 1 per cent. in the carbon or 0·5 in the hydrogen should never occur. To report the carbon and hydrogen, however, to three places of decimals, as is sometimes found, is absurd. The *nitrogen* can be fairly readily determined by the use of modern methods, and is chiefly of importance in cases where it is desired to recover ammonia and other nitrogen compounds from the products of distillation. If this is not required, the oxygen and nitrogen are frequently counted together, and often pass as "oxygen." At any rate, the amount

of oxygen is invariably determined as the difference between 100 and the sum of the other elements. It therefore bears the accumulated errors of analysis, as well as the error introduced by considering the ash as representing the mineral matter. For these reasons it is not suitable for purposes of classification.

The ultimate analysis, as far as concerns the carbon and hydrogen, is a perfectly definite thing, and not dependent (saving errors in analysis) upon any convention as to the mode in which it is determined. It is, therefore, an exceedingly valuable datum, and no investigation of a coal can be considered complete without it. Its value is becoming increasingly appreciated as we are gradually learning to interpret the results.

It is one thing to be able to make an accurate analysis of a coal, and quite another to be able to express the results so that they shall be intelligible and comparable with other analyses, and yet another problem to interpret the results when so expressed.

The best way to express the results, so that they may be comparable with each other, is a matter demanding attention. The results appear unintelligible as long as they are complicated by the inclusion of matters which are *not coal*, either water or mineral matters. The amounts of water, ash and sulphur (in the form of pyrites) are very important to the coal user by reason of the fact that they are impurities. But for the purpose of comparing the composition of the true coal they are accidental and unessential, and must be eliminated before any rational comparison can be made. It is usual to include the "combustible sulphur" with the moisture and ash as impurities, and to calculate the composition of the coal after their elimination. This can be done as follows:—Subtract the percentage of moisture, ash and sulphur from 100. Divide the percentage of carbon, hydrogen, &c., by this number and multiply by 100, and the results express the composition which the coal would have if it were composed purely of carbon, hydrogen, oxygen and nitrogen. Expressed in formulæ, we may put the matter thus: Let W be the percentage of moisture, A the percentage of ash, and S the percentage of combustible sulphur, then multiply the percentage of each constituent (C, H, O and N) by the factor

$$\frac{100}{100 - (A + W + S)}$$

A few analysts whose results figure in this collection have followed the example set by Dr. Percy and made this calculation upon their certificates and given not only the composition of the dry sample, but the "composition per cent. exclusive of sulphur, ash and water." This is an excellent sample and should be more widely followed, as it would conduce largely to a proper understanding of the meaning of the analysis. The necessity of this will easily be seen if we consider, for instance, two samples of anthracite, both of exactly the same nature but containing respectively 1 per cent. of ash and 10 per cent. The ash in the latter case may be derived from admixture with shale, roof, or floor. Suppose the anthracite in the pure state to contain 92 per cent of carbon, then in the first case the carbon will be reduced to

93 per cent., and in the latter to 83·7 per cent. The coals will appear to be entirely different, whereas elimination of the ash will show them to be identical. Thus real identity and real diversity are alike hidden, and all possibility of comparison is lost. It is neglect of this consideration which causes many commercial men to conclude that chemical analysis is of no value. The same calculation must be applied to the volatile matter and calorific power, since all these values are simply decreased, or, as it were, diluted by the presence of the impurities. It is true that the sulphur may contribute to the calorific power, but if present as pyrites this effect does not belong to the coal proper.

Having considered the proper form in which to express the results of analysis, let us now turn to the question "How are we to interpret these results?" What conclusions can be drawn from them as to the nature of the coal and the purposes for which it is suitable?

After we have made a decision on this point, we may give due weight to the amounts of impurities present according to the purpose to which we wish to apply the fuel. In the first place, we do not wish to pay for moisture at the price of coal. Further, the moisture not only diminishes the calorific power, but represents so much additional water to be evaporated. Again, the amount of ash not only dilutes our fuel, but represents so much inert matter to absorb heat, to obstruct draught, diminish caking power, and carry unburnt fuel away with it. Its fusibility or liability to clinker, its composition, the amounts of iron, silica, sulphur, phosphorus, and arsenic may also be of importance.

We require, however, information as to the positive properties of the coal, its calorific power, caking power, yield of coke, length of flame, amount of smoke, mechanical properties, rapidity of burning, and other factors, which together go to make up the character of the coal.

The direct determination of the yield of volatile matter and calorific power will give us positive information upon some of these points, but others are not easily expressed in quantitative form.

For the purpose of "clearly conceiving and retaining in the memory the characters" of a given coal we require to be able mentally to *classify* it. By this we mean that we require to gather together into separate classes all those coals which are alike in as many particulars as possible, and to separate them from those which are unlike. The purpose of the classification is therefore eminently a practical one. It is the solution of the question which continually faces the analyst or the coal-user when called upon to decide upon the character of a coal, and its suitability for a given purpose.

We may classify coals by many properties: by their physical appearance, their calorific power, their yield of volatile matter, or their composition. The most useful classification will evidently be one which chooses a property which is a cause, or at any rate an accompaniment, of as many other properties as possible. Some sort of rough classification is universal. In the first place there are the

commercial classifications, such as we shall find appended in this collection. These are based either upon the purpose for which the coal is considered to be most useful, such as gas, house, steam, coke, smith's or manufacturing coal, or upon the physical properties or behaviour on burning, as in the terms Anthracite, Bituminous, Semi-bituminous, Cannel, Splint, Lignite. The former terms are not definite, since many coals are equally well suited for various purposes. The latter terms are useful, but are so far ill-defined, and usage in different districts varies. Terms like Anthracite, Semi-anthracite, Bituminous, Semi-bituminous, Lignitious and Lignite are, however, the expression of the general characters of certain fairly well marked kinds of coal, and if they can be made definite will form a suitable basis for naming the various classes.

Many attempts have been made to define these classes upon the basis of chemical composition or assay. One of the commonest is that which uses the amount of volatile matter. Such, for instance, is the classification of Hilt (1873), based upon the volatile matter expressed as a percentage of the fixed carbonaceous residue, $\frac{V}{(1-V)} \times 100$. This is in principle precisely the same as that proposed by P. Frazer and widely used in America, which depends upon the so-called "fuel ratio," $\frac{1-V}{V}$, or ratio of the fixed carbonaceous matter to the volatile matter. These depend upon the amount of volatile matter alone, and it is often forgotten that there is no special virtue in the particular form of ratio chosen. They are only disguises of the amount of volatile matter in the pure coal, and if they possess any greater value than this it lies only in the ease with which the calculation is made from the results of the analysis. Thus to convert Frazer's classification into terms of volatile matter we have:—

	Fuel ratio.	Volatile matter.
Anthracite	100 to 12	7·7 and under (to 0·99)
Semi-anthracite	12 to 8	7·7 to 11·1
Semi-bituminous......	8 to 5	11·1 to 16·7
Bituminous	5 to 0	16·7 and over (to infinity !)

This agrees fairly well with the limits of volatile matter usually assigned in South Wales to these classes, which may be taken roughly as up to 8 per cent. for anthracite, 8 to 10 for semi-anthracite, 10 to 14 for dry steam coals ("quater-bituminous"), 14 to 20 for semi-bituminous, 20 to about 40 for bituminous, and over 40 for long-flame non-caking coals (lignitious).

Though, like Hilt's, it answers fairly well for the coals between anthracite and semi-bituminous, it fails egregiously in throwing all coals beyond 16·7 per cent. of volatile matter into one class. It also does not distinguish properly various classes of anthracite, such as the Red Vein anthracites of South Wales. A further defect lies in the fact that it is based upon a conventional assay such as the volatile matter, which varies in value according to the method used. This objection applies also to Parr's recently proposed classification, based upon the ratio of the "volatile carbon" to the total carbon. This involves in addition the objectionable features of the idea

of "fixed carbon," and is not improved by being complicated by the amount of actual carbon. Parr's classification avoids leaving the bituminous and lignitious coals without sub-division by introducing the idea of "inert volatile matter," which is only a disguise for the amount of oxygen. This brings us to the consideration of those classifications which are based upon the ultimate composition—that is, upon the amounts of carbon, hydrogen, or oxygen. These alone are founded on analytical data which are free from ambiguity. Of these the earliest is that of *Regnault*, who was the first to make accurate ultimate analyses of coal. He found that the chief well-defined commercial classes were contained between narrow limits of chemical composition, and showed that the amount of oxygen was a very characteristic property of each class. Gruner, the celebrated French metallurgist, extended Regnault's results, and gave limits for the chief classes. His classes are the same as Regnault's, and are still in the main the most suitable divisions which we can adopt, viz. :—

1. Anthracite.
2. Lean or anthracitic coals.
3. Short-flame bituminous coals.
4. True bituminous coals.
5. Long-flame bituminous coals.
6. Dry long-flame coals.
7. Lignite.

The chief defect of Regnault's and Gruner's classifications is the fact that the oxygen bears all the errors of analysis, and is therefore not a very good basis for classification. Another defect is that they do not sufficiently recognise the important part played by the hydrogen. This was first shown by Fleck (1866-1870), who introduced the idea of "disposable hydrogen," or hydrogen left after deducting that equivalent to the oxygen. Fleck used as a basis of classification the ratio of the disposable hydrogen to the carbon, $\frac{H}{C} \times 100$, as one factor, and the "combined hydrogen" (which depends really on the oxygen) as the other. He was the first to see that there was a close relation between the amount of hydrogen and the caking power, but unfortunately did not determine the volatile matter. In 1900 the present writer re-examined the whole subject, and found that Regnault's thesis was essentially correct—namely, that the typical classes of coal are confined within narrow limits of ultimate composition. The amount of *carbon*, however, was substituted for Regnault's and Fleck's oxygen. It was further found that for coals rich in carbon there was a close relation between the hydrogen and volatile matter, as well as the caking power. The outcome was a classification based upon both the hydrogen and the carbon, which in the main adopts the classes distinguished by Regnault and Gruner, but substitutes the percentage of carbon for that of oxygen, and the total hydrogen for the ratio of disposable hydrogen to the carbon used by Fleck. Below 84 per cent. of carbon the percentage of carbon alone was used

as the chief basis of classification, these coals forming what was called the *lignitious* genus, corresponding to the dry long-flame coals of Regnault and Gruner, and sub-divided into species (according as the hydrogen was high or low), *e.g.*, the per-lignitious, lignitious and sub-lignitious coals. Above 84 per cent. of carbon the hydrogen was found to be the chief factor which determined the character of the coal, and five chief genera were distinguished as follows:—

	Hydrogen.	Approximate volatile matter.
Anthracite genus	Up to 4 per cent.	Up to 10 per cent.
Carbonaceous genus	4 to 4·5 ,,	10 to 16 ,,
Semi-bituminous genus	4·5 to 5·0 ,,	16 to 24 ,,
Bituminous genus	5·0 to 5·8 ,,	over 24 ,,
Per-bituminous genus	5·8 and over	

These values for hydrogen were found to agree, generally speaking, with the limits of volatile matter above, but the volatile matter may vary to some extent, and no stress is laid upon it for purposes of classification.

The typical coals of each genus were found to lie between narrow limits of carbon, and therefore these genera were sub-divided according to the carbon.

Thus the true anthracites were found to have carbon over 93·3 per cent., and were called ortho-anthracites (from the Greek *orthos*, true, typical) while those with the same hydrogen but lower carbon were distinguished as pseudo-anthracites (*pseudes*, false, atypical). There is a real and commercial distinction between these n South Wales.

The typical *carbonaceous* coals include the celebrated Welsh smokeless steam coals for naval purposes, and have carbon between 91·2 and 93·3, but coals of the same genus (and with the same hydrogen) are occasionally found with more or less carbon, and are called semi-anthracite or pseudo-carbonaceous according to their carbon.

The true *semi-bituminous* coals have a higher hydrogen, volatile matter and caking power, and include the nearly smokeless steam coals used for bunkers. They have the same carbon limits as the carbonaceous coals, but coals of the same genus but lower carbon are sometimes found which are called "sub-bituminous."

For most purposes it is sufficient, in the case of the carbonaceous and semi-bituminous coals, to specify the genus to which they belong according to the hydrogen, but if desired the species may also be indicated by the carbon. In the case of anthracites, however, the species as determined by the carbon is of considerable importance.

The *bituminous* coals have hydrogen 5 to about 5·8, and when the hydrogen exceeds this limit it is advisable to distinguish them as *per-bituminous*. The amount of carbon now becomes important, and we distinguish three classes according to their carbon, viz.:—

Meta-bituminous coals, carbon 91·2 to 89. These are uncommon in Britain outside South Wales, but are allied to the true bituminous coals, and are suitable usually for coking or smiths' purposes on account of their high yield of coke. They

are usually best used in horizontal coke ovens with or without recovery o: by-products. The No. 2 and No. 3 Rhondda and other well-known Welsh coke-coals belong to this species, and they correspond well to Gruner's short-flame bituminous coals. When the hydrogen exceeds 5·8 we get per-bituminous coals (per-meta-bituminous), which include a few of the Hartley steam coals.

The *ortho-bituminous* (or true bituminous coals of Gruner) have a lower carbon, 89 to 87. They include the celebrated Durham coke-coals, some of the more bituminous Welsh coke-coals, and the similar American Connellsvile coals—all most frequently treated in the beehive oven. They are also suitable for gas-making.

When the hydrogen exceeds 5·8 we get into the per-bituminous genus (per-ortho-bituminous), and this includes a few cannels or bastard cannels.

The *para-bituminous* coals, with again the same hydrogen, have a still lower carbon, 87 to 84 per cent. They correspond to the long-flame bituminous coals of Gruner. When the hydrogen approaches the upper limit (over about 5·5 per cent.) they form, as a rule, good steam coals of the flaming or North-country type, but are also suitable, with a hydrogen lower than this, for gasmaking. The per-bituminous genus here includes many long-flame steam coals, and with still more hydrogen pass into cannels.

Below 84 per cent. of carbon we get a genus of coal which is intermediate in properties between bituminous coal and true lignite, and we term it *lignitious*. The coals may be per-lignitious or sub-lignitious, according as the hydrogen exceeds 5·8 or falls below 5 per cent., and are further sub-divided into the meta-lignitious species (84—80 per cent. carbon), and ortho-lignitious (80—75 per cent. carbon). They correspond to Gruner's dry long-flame coals, suitable for steam-raising, with a few gas coals when the hydrogen is towards the lower limit.

To use this classification, it is only necessary to calculate the hydrogen and carbon after elimination of the ash and sulphur. If the carbon is above 84 per cent., the hydrogen will then at once tell us the genus to which the coal belongs, and the carbon its species, if we desire to discriminate further. If below 84 per cent., the carbon will tell us the genus, and the hydrogen will further classify it if necessary. When the species is determined we shall know at once the general characters of the coal, and shall be able to compare it with other members of which the behaviour is known in practice. Many such examples will be found in these pages. A general synopsis of the classification is appended. It is only to be remarked that the full designation of the species is rarely necessary. Thus, it usually suffices to know whether a coal is a true anthracite or a pseudo-anthracite, without its being necessary to enquire if the species be sub-carbonaceous, sub-meta-bituminous, &c. The full designation of each species is, however, given for the sake of completeness.

Recently, Campbell, of the United States Geological Survey, has proposed to classify coals by the ratio of the carbon to the hydrogen $\frac{C}{H}$. This basis is in

principle not different from the *hydrogen expressed as a percentage of the carbon*, $\frac{H}{C} \times 100$, instead of as a percentage of the pure coal. It is identical with Fleck's factor, substituting the total hydrogen for the disposable hydrogen. Such a basis would answer very well to distinguish the genera above 84 per cent. of carbon and would not be inconsistent with the classification above suggested, except that there would be a slight overlapping at the border lines of the genera. It is, however, questionable whether it offers any advantage over the percentage of hydrogen alone. Below 84 per cent. of carbon there is no doubt that it is inadequate and that classification by the carbon alone is the most important basis. It is, however, a great advance upon the ordinary American practice and by no means irreconcilable with the classification above suggested. As regards the analyses of coke, little need be said except to utter a warning against the use of the term "fixed carbon" or even "carbon" obtained by difference. This always contains nitrogen, oxygen, and even hydrogen. It is true that in some cases these do not together amount to more than about ·6 per cent., as in the one complete analysis of coke given in this collection; but this is by no means always the case. Indeed, the nitrogen alone is rarely under ·5 per cent. and may rise to over 2 per cent. In some cokes analysed by Muck the hydrogen was as much as 2 per cent. and the oxygen and nitrogen rose to over 7 per cent.

For ordinary purposes no doubt the amount of impurities is of more importance than the composition of the carbonaceous residue, but it is well to bear in mind that this is by no means pure carbon.

To make the fullest use of the *Colliery Guardian* collection of analyses the reader should select those which interest him (if complete data are given) and recalculate the results after elimination of moisture, ash and sulphur. By referring to the accompanying table of classification he will then be able to assign them to their proper genus and species, the characters of which have been already briefly indicated, and will be able to amplify this description in many cases from his own personal experience.

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SEYLER'S CLASSIFICATION OF COAL.

Carbon.	Anthracitic.	Carbonaceous.	Bituminous.			Lignitious.	
			Meta-	Ortho-	Para-	Meta-	Ortho-
	Carbon over 93·3 per cent.	93·3—91·2	91·2—89·0	89·0—87·0	87·0—84·0	84—80	80—75
PER-BITUMINOUS GENUS Hydrogen over 5·8 per cent.	—	—	PER-BITUMINOUS Per-meta-bit.)	PER-BITUMINOUS (Per-ortho-bit.)	PER-BITUMINOUS (Per-para-bit.)	PER-LIG	NITIOUS
BITUMINOUS GENUS Hydrogen 5·0—5·8 per cent.	—	(Pseudo-bituminous species)	META-BITUMINOUS	ORTHO-BITUMINOUS	PARA-BITUMINOUS	LIGNI (Meta-)	TIOUS (Orth o-)
SEMI-BITUMINOUS GENUS Hydrogen 4·5—5·0 per cent.	—	SEMI-BITUMINOUS SPECIES (Ortho-semi-bituminous)	SUB-BITUMINOUS (Sub-meta-bit.)	SUB-BITUMINOUS (Sub-ortho-bit.)	SUB-BITUMINOUS (Sub-para-bit.)	SUB-LIG (Meta-)	NITIOUS (Ortho-)
CARBONACEOUS GENUS Hydrogen 4·0—4·5 per cent.	Semi-anthracitic species	CARBONACEOUS SPECIES (Ortho-carbonaceous)	PSEUDO-CARBONACEOUS (Sub-meta-bit.)	PSEUDO-CARBONACEOUS (Sub-ortho-bit.)	PSEUDO-CARBONACEOUS (Sub-para-bit.)		
ANTHRACITIC GENUS Hydrogen under 4 per cent.	ORTHO-ANTHRACITE	PSEUDO-ANTHRACITE (Sub-carbonaceous)	PSEUDO-ANTHRACITE (Sub-meta-bituminous)	PSEUDO-ANTHRACITE (Sub-ortho-bituminous)	PSEUDO-ANTHRACITE (Sub-para-bituminous)		

N.B.—The various genera are arranged in column I. vertically according to the hydrogen. The species in each genus are arranged horizontally according to the carbon.

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